

HYLEBOS WATERWAY

ALLOCATOR'S FINAL COST ALLOCATION FORMULA REPORT

May 22, 2000

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The calculation of the allocation percentage on the Investigation Cost Spreadsheet is determined by:

$$\{\text{Years}\} \times \{\text{RM Score}\} \times \{\text{SQO Score}\} = \{\text{Total Score}\}$$

$$\frac{\{\text{Total Score}\}}{\{\text{Sum of all Total Scores}\}} = \text{Allocation Percent}$$

Years of involvement generally are determined by the number of years a party owned property and/or was involved in some way in the operations of contaminating-producing facilities on a particular parcel. Where parties have been involved with disposal of materials on a parcel, years of determined are based on years from disposal to the date of removal or containment of the disposed materials (or the present, if no removal or containment has occurred).

As discussed above, the RM and SQO scores are comparative scores, based on my qualitative assessment of the difference in the severity of chemicals associated with the activity and the magnitudes of releases of contaminants of concern. Throughout this section of the report, I have used terminology to describe the magnitude of the releases. This terminology is translated into a RM score in the following way:

- Minimal 1-5
- Modest 6-15
- Appreciable 16-30
- Significant 31-45
- Major >46

EXHIBIT D PARTY DESCRIPTIONS

Airo Services (Crown Tank), the subject of a first round cash-out recommendation, has operated on parcel 62 for about 10 years. This is a small parcel that is likely to have modest surface water runoff. Stormwater on the site is routed to the Hylebos through storm drains that discharge north of the 11th Street Bridge. The only potential source of a release of contaminants is associated with the storage of wastewaters and truck washing. In 1990, Ecology noted that material from a tank truck was discharging to the containment structure surrounding the tank farm. Ecology's report noted that the containment structure surrounding the tank showed obvious signs of cracking, and that the liquid was black with a petroleum odor.

Stormwater that is collected in the containment structures on the tank farm and truck washout areas has been pumped out and disposed off site during Crown Tank's operation. Stormwater from the remainder of the site is discharged through two storm drains that are connected to the City of Tacoma stormwater sewer system. Empty drums and some soil staining have been observed on portions of the site during the period of Crown Tank's operations.

While we do not have strong evidence of releases from the tank area to the Hylebos, we recognize that there is some uncertainty regarding whether, and to what extent, substances from the contained tank area may have been released to the Hylebos during Crown Tank's operations. Although we have not determined that Crown Tanks was a source of PCB releases into the Hylebos, we note that PCBs were sampled in the tanks on the property. Conceivably, residual PCBs could have been present in tank trucks and included in any tank truck washings or spills on the site. We have attributed modest releases of PAHs, and possibly, PCBs from this source

Airo Services (Dan Nobel) owned and operated on parcel 62 for about 10 years. This operation was similar to that of Crown Tank's operation that succeeded it. Because it appears that there may have been less stringent controls on stormwater collection, we have inferred that the potential for releases of PAHs and PCBs was somewhat higher during the ten years of operation of this facility under Dan Nobel than it was during Crown Tank's operation. We believe that the release magnitude was modest and that SQO concentrations were not above regulatory levels.

AK-WA Shipbuilding leased a portion of parcel 1 from the Port of Tacoma between May 1986 and approximately 1998. AK-WA's 12 years of ship repair activities released metals and oil and grease contaminants to the waterway. Untreated hydroblasting wastewater, which contained copper and zinc, was discharged to the Hylebos. After receiving a permit, this release continued to contain elevated levels of metals (copper, zinc, and lead) and oil and grease until approximately May 1993, when a treatment system was installed. Spent sandblasting grit, which was stored in an area near catch basin drains, may also have potentially released metals to the waterway. PAHs associated with oil and grease contaminants may have also been released to the waterway via oil spills.

We attribute metals and PAHs to this party. AK-WA has had a process discharge from hydroblasting activities estimated to be 140,000 gallons per year, in addition to surface water runoff from its 2.3-acre site. We assume that it had an appreciable release magnitude for metals and that SQO chemicals exceeded regulatory levels.

Allen, Barbara, a first round cash-out party, has owned parcel 61a for about 20 years.

Anderson, Mary B. owned a portion of parcel 22a for about 50 years.

AOL Express has owned and operated on parcel 14 for 16 years, storing and packaging groceries and household items for shipment to Alaska.

There is some uncertainty concerning pathways from this site to the Hylebos. Investigations have suggested that only the northeastern portion, used for vehicle parking, discharges to the Hylebos. However, a January 1992 Department of Ecology report indicates that on May 14, 1991 Ecology sampled the sediments from a catch basin located on the south corner of the truck loading dock, which is near the terminus of the storm drain system which joins the city system at Lincoln Avenue and Taylor Way, and ultimately discharges to the Hylebos. Elevated concentrations of PCBs, TPH and some metals were detected.

We have attributed a minimal release from this 6.5-acre site. We note that AOL was notified that its vehicle wash practices were in violation of state regulations in 1991. We attribute PCBs, metals and PAHs to AOL at elevated concentrations. The source of PCBs on this site has never been identified, and there is no evidence demonstrating that AOL is the source. However, we note that the potential for offsite migration of PCBs has been present during AOL's 16 years on the property.

Asarco, a second round cash-out party, is linked to the Hylebos Waterway at a number of parcels. Asarco sold slag that was used as road ballast at numerous log yard sites. The mixing of woodwaste and slag caused metals to leach from the slag. Runoff from these log yards discharged to the Hylebos. In addition, mixed woodwaste and slag was disposed of at certain landfill sites that also had pathways to the Hylebos via Morningside Drain and Hylebos Creek.

It is my understanding that Asarco has entered into Hylebos sediment cleanup settlements with the Port of Tacoma and Log Yard operators at five of the log yards at which its slag was placed.²⁹ Those allocations are not reflected in this report. However, separate allocations are provided with respect to each parcel for the slag portion.

The various sites that used Asarco slag are of varying sizes and some do not front the Hylebos. Releases of metals in elevated concentrations are associated with use of slag. The releases generally are through surface runoff. The magnitudes of releases reflect that the slag, when mixed with woodwaste, leaches metals from all surface, and in some cases groundwater pathways. As shown by the Investigation Cost Spreadsheet, I have rated the releases from minimal for some of the parcels not directly on the Waterway. For the major logyards, I have attributed a modest release of metals to Asarco. As to the number of years associated with the releases, I have assumed that the intermixing of slag with woodwaste occurred from the approximate time of its placement on the site to the approximate time that upland areas were remediated.

Asarco slag is present at other locations along the Waterway. These other parcels are noted in the investigation cost spreadsheet. Metals associated with these additional parcels are attributed partially to Asarco slag in minor amounts, and partially to other activities that are known to have operated at these locations. Asarco slag was used by USG as a raw material in its mineral wool production process. As discussed above, I have not allocated any investigation cost share to Asarco for this parcel. I also have not allocated to Asarco any portion of the arsenic associated with releases from Elf Atochem's Penite manufacturing. Elf purchased arsenic trioxide from Asarco as a raw material in its Penite production process.

B & L Trucking, was the subject of a first round cash-out recommendation. It was one of a number of companies associated with William Fjetland. It disposed of fill material at parcel 31 for about 3.3 years, operated at parcel 72 for about 20.5 years and may have been involved in transportation of wastes to parcel 76 for about 3 years. Sources of potential releases of contaminants at parcel 72 are associated with the use of oils in the maintenance shop, and from

²⁹ Murray Pacific Log Yard #1, Murray Pacific Log Yard #2, Portac Log Yard, Cascade Timber Log Yard #3, and Wasser & Winters Log Yard.

slag and woodwaste distributed along the facility. The source of potential release from parcel 76 is from the dumping of slag and woodwaste (a source of phenols) containing slag, and automobile demolition debris containing metals and PCBs. I view the releases to the Hylebos as being of modest amounts. The releases were to Hylebos Creek, some distance from its entry into the Hylebos.

Babet Fund III owned parcel 52 for 13 years. I have attributed to them a 15% share of the investigation share of associated operations at that parcel.

Banyan Rail operated on parcel 61a for about 5 years. Banyan Rail conducted a rail service operation in which it installed and repaired railroad tracks off site. Potential releases associated with Banyan Rail's activities appear to have been related to operations in the maintenance yard and the washing of equipment. Ecology has cited Banyan Rail for oil spills on the parking areas and improper storage of petroleum products. Ecology also found that residues from maintenance, waste fuels, oils, and material in storage commingled with stormwater from the service yard, which eventually discharges to the Hylebos Waterway. We have attributed modest releases of PAHs and metals at elevated concentrations to Banyan.

Barton Marine Supplies has operated at parcels 52a, and 53 for about 8 years. We have not documented any specific releases associated with this operation. However, this party has not disclosed information for purposes of allocation. We infer a minimal release of metals and PAH contaminants from boat repair operations.

Bay Chemical, a first round cash-out party, operated on parcel 62 for about 22 years. Although it operated on a small parcel, we have attributed it modest quantities of releases from routine operations. The source of potential release of contaminants is from stormwater runoff and/or subsurface drainage of truck washing wastes that Bay Chemical disposed of on site, and zinc sulfate. We have assumed that releases of zinc were in excess of SQO levels, although there is no specific sampling data. This is based on the fact that the zinc discharge appears to have been toxic enough to cause fish kills. We have also inferred the potential for releases of oils and grease, resins, and other chemicals into the Hylebos from truck washing activities. In addition, I note that sludge from Bay Chemical's activities remained on site after the company left the parcel. Releases are considered modest.

Brazier Forest Industries owned parcels 11 and 12 for about 1 year. We have not identified specific operations during the period of time the parcels were owned by Brazier Forest Industries or John and Dorothy Brazier (see next entry). Based on research conducted by Taylor Way Properties, it is possible that grading operations by the Braziers may have spread PCB and metals contamination throughout the site. The property was in a contaminated condition when the Braziers sold it to Taylor Way Properties. Accordingly, we have attributed to the Brazier entities modest releases from this parcel of elevated concentrations of PCBs, metals and PAHs, similar to the attribution to Taylor Way Properties.

Brazier, John and Dorothy owned parcels 11 and 12 for about 12 years. See discussion immediately above.

Brown, Boardman W. Beginning in 1942, Buffelen leased approximately 0.81 acre of land on parcel 22a from Mary Jane B. Anderson and Boardman Brown. It is a minor portion of the Buffelen Woodworking manufacturing site.

Buffelen Woodworking, a second round cash-out party, has owned and operated on a number of parcels since it was incorporated as an employee-owned corporation in 1955. They include:

- parcel 14 for 18 years (storage of green lumber, no releases identified);
- parcel 16 (no operations identified);
- parcel 20 for 44 years (main plant for manufacturing stile and rail doors and operation of a steam plant);
- parcel 22 for 11 years (operation of the steam plant); and
- parcels 52a and 53 (undeveloped land during Buffelen's ownership).

Contaminants of concern associated with the manufacturing operations include phenols, PCBs, metals, PAHs, organics, and phthalates.

Operations at parcel 20 have included extensive use of glues as well as other chemicals, including pentachlorophenol (PCP). Releases from the facility occurred via direct discharges from the plant to the waterway. For approximately 21 years, urea formaldehyde and phenol formaldehyde glue wash water was discharged to the Hylebos. Between 600 and 800 gallons of the urea formaldehyde glue wash water was discharged per day. Other releases occurred through spills to the waterway and soil. In 1958 there was a large release of glue to the waterway, when the valve on a bulk storage tank was released. Additional releases of phenol-based glues have been observed in the vicinity of Buffelen's outfall. The potential for these direct releases to the waterway existed until 1986 when a concrete berm was installed around the glue machines to contain spills.

Onsite soils around the spray application booth and an area around the underground storage tank have been contaminated by PCP. Spills in the vicinity of the spray booth may have been a result of overspray and drippings from the containment tray, while spills in the area of the storage tank probably occurred between 1982 and 1986 during manual transfer of PCP from 55-gallon drums to 5-gallon pails. PCP has been detected from 120 ppm to 14,000 ppm in six soil samples within a circular area of the former PCP treatment shed. Concentrations at three feet below ground surface were less than 15 ppm. The contamination was underlain by a ten-foot thick clay layer, and groundwater monitoring did not detect PCP in groundwater. It was determined that erosion was the principal pathway from the tank area to the Hylebos Waterway.

PAHs, organics, phthalates, and PCBs also have been detected in the PCP treatment area. PAHs were detected below SQOs, but xylenes, bis(2-ethylhexyl)phthalate (BEP), and PCBs (Aroclor 1254 max. 4,500 ppb) were detected above SQOs. The organic (xylene) and PAH contamination may be related to the PCP carrier fluid which was probably a petroleum product. Because the treatment area is located in a topographic low, the main pathway from this area is assumed to be groundwater. Sources of PCBs and BEP in this area are unknown.

Releases of metals and, possibly, PCBs are associated with the machine shop that was situated on pilings and protruded out over the inclined beach of the Hylebos Waterway. Metal filings were swept through the floor and onto the beach where they accumulated in a pile. During high tide, the pile was under water. A sample collected in 1987 from the floor sweepings debris pile contained metals, including arsenic, zinc, copper, and lead, at concentrations above SQOs. PCBs were also present in the debris pile at a concentration of 550 ppb. The pile was removed in a subsequent independent remedial action.

Releases of petroleum related compounds also are associated with the sump pit and machine shop. Sump-pit discharges to the Hylebos, which occurred until 1976, contained hydraulic fluids. In the late-1960's the Department of Ecology observed oil dripping into the waterway from the machine shop.

We have attributed releases of a number of the above-mentioned contaminants. We note that Buffelen has provided data showing that that, although there are PCBs on portions of the site, there is a decreasing gradient from the site to the Waterway, indicating that on-site releases may not have migrated to the Waterway from the parcel. However, given PCB detections in intertidal and subtidal areas proximate to its machine shop, we have inferred that Duffelen's operations are a source of PCBs in Waterway sediments.

I have attributed to Buffelen's activities a modest RM. A substantial portion of its releases was non-contact cooling water.

Burlington Environmental (formerly ChemPro) is the successor to Chemical Processors. Please see discussion, below, under Chemical Processors.

Cascade Pole & Lumber/McFarland Cascade Holdings owned parcel 56 for 26 years, operating on it for 5 of those years. Organics associated with petroleum compounds (ethylbenzene and xylenes) and PAHs were detected in soil borings from the wells (the subsurface) – however, groundwater is not considered a potential pathway to the Hylebos, except for the seep noted. There is no evidence of surface soils containing these contaminants. We have attributed minimal releases of organics, phenols and PAH compounds from this yard.

Cascade Timber operated log yards on parcels 26 for about one month, parcel 56 for 4 years, parcel 17 for 10 years, parcel 28/70 for 2 years, and parcel 67 for 16.5 years. In addition to metals contamination from slag, these log yards are sources of woodwaste and possible sources of PAH contamination from use of heavy equipment. Based on the evidence in the record, we can attribute only minimal-to-modest releases of PAH and phenol compounds to Cascade log yards.

Cenex Agriculture, a first round cash-out party, owned parcel 19 from 1982 through 1996. From 1982 to January 1987, Cenex operated a manufacturing plant for animal feed. In January of 1987, Cenex began leasing the property to Land O' Lakes/Cenex Feed, Inc., which manufactured animal feed at the plant until it closed in October 1990. Ryder Trucks also leased a portion of the parcel for its truck maintenance facility. Potential releases of contaminants are associated with the use of underground and waste oil storage tanks and the truck maintenance facility.

We have attributed to Cenex modest releases of PAHs and organics and zinc from its operations and an ownership share for the minimal releases associated with its tenants.

Chemical Processors has owned and/or operated a chemical processing facility on parcel 10c/13 for about 22 years.

Potential releases of metals, PAHs, phenols, and organics are associated with Chemical Processors' waste oil recycling, dangerous waste treatment, and storage facility that was located on Parcel A. The unlined waste oil pond was used between 1972 and 1975. The pond was reportedly used for storage of wastewaters generated during the reclamation process, petroleum sludges, and oil to be reclaimed at the facility. Soil and groundwater at the site has been contaminated by organic compounds, metals, PAHs, and phenols.

Historically, PAHs, metals, and organics have been released to the environment through spills and poor waste management practices. It was reported that considerable dumping of oil on the property occurred when no one was around. The chemical processing storage tanks and activities took place on the southern portion of the property.

Release pathways to the Hylebos Waterway from this parcel are unclear. It appears that the majority of the contamination was located in the southern portion of the property that has a drainage system that ultimately discharges to the Blair Waterway. In addition, it appears that groundwater from this area of the site flows south towards the Blair.

However, a Department of Ecology Milestone Status Report indicates that, when AOL Express began operations on neighboring parcel 14, runoff from the Chemical Processors operations flowed to a marsh and drain on AOL's property. This drain ultimately flowed to the Hylebos Waterway. Sometime after the drain was installed in 1983, it ceased to function and AOL ceased use of the drain and reverted back to the old system of pumping the water to the Lincoln Avenue ditch that ultimately drained to the Blair Waterway. PAHs and metals may have been detected west and north of the ChemPro facility, an area that could potentially discharge to the Hylebos. In addition, we have assumed that there was a potential for releases of all chemicals associated with Chemical Processor's operations to the Hylebos via storm water runoff, for a short period of time circa 1983. In addition, we note that generally shallow groundwater flows to the Blair Waterway, but under some conditions may flow to the northeast towards the Hylebos Waterway. We have also assumed potential releases via groundwater.

Chemical Processors has done some contract work on parcels 11 and 12. We have no basis for assignment of an allocation share with respect to this work.

City of Tacoma Department of Public Utilities, a second round cash-out party. Since 1932 the City of Tacoma, Dept. of Public Utilities, Light Division has used parcel 8 for a steam electric generating plant and electrical switching station. It has owned parcel 10a for 70 years. Parcel 2 of the City of Tacoma's Steam Plant No. 2 (Parcel 8) is located on parcel 10a. Parcel 10a is essentially undeveloped except for a substation in the southeast corner, near Alexander Avenue. The City of Tacoma also used this parcel for extra fuel storage of old material from the road bed of the Belt Line Railroad. The City of Tacoma purchased parcel 27 from Ohio Ferro Alloys in 1942 and used it for a substation until 1976. The City leased the property to Pacific Northwest Processing ("PNP"), which operated a rendering plant for a number of years prior to 1977.

Contaminants potentially associated with operations on parcel 8 include PCBs, metals, PAHs, and phenols. Historically, oil in the electrical equipment in the substation had been contaminated with PCBs up to a couple hundred parts per million. From at least 1944 until an unknown time period, storm drainage from the substation area discharged to the Hylebos. In addition, transformer bank cooling water overflow also discharged to the Hylebos during this time period. The switching station, which contained circuit breakers, also contained oil contaminated with PCBs (approximately 150 ppm). The area beneath the switching station is graveled and uncontained.

Circa 1991-1992 petroleum contaminated ballast was used for fill on parcel 8. A July 1992 Department of Ecology memorandum indicates that soils from the ballast pile contained 703 ppm of arsenic. It is not clear where this material was placed and whether metals and petroleum contaminants could reach the Hylebos via surface water runoff. Arsenic and lead were detected in the groundwater of the parcel of land located between Alexander Avenue and Taylor Way. It is not clear where this contamination is from. It also is not clear whether groundwater flows to the Hylebos.

The swale, which receives discharge from the oil/water separator and runoff from non-contact areas of the plant on parcel 8, discharges to the Hylebos. Sediments in the swale contained 4-methylphenol in exceedance of the SQO.

From 1932 to 1949, coal ash was washed from the boilers down a sluiceway to an ash settling pond. From 1949 to 1973, oil ash was disposed in the pond. Excess water from the settling pond discharged directly to the Hylebos. We have assumed that the coal and oil ash were potential sources of PAHs.

From 1932 to 1983, cooling water and untreated sewage discharge was discharged to the Hylebos via two outfalls. A 1972 permit application indicates the average discharge of the cooling water was 0.197 million gallons per day. Several contaminants, including chlorinated hydrocarbons, oil and grease, and phenols were present in cooling water discharge. In 1983 the plant was redesigned so all drainage associated with fuels and/or processes would be contained and not discharged to the Hylebos.

There is also a potential for releases of petroleum-related compounds from the fuel tanks. Releases to the soil surrounding the tanks are evidenced by contamination discovered in 1988.

Contaminants potentially associated with operation on parcel 10a include PAHs, metals, and phthalates. These contaminants are associated with the petroleum-contaminated fill that was stockpiled on the site and other various debris (empty 55-gallon drums, empty paint cans, automobile tires, creosoted logs, and household and demolition debris) found during a 1991 investigation. Metals, PAHs, and phthalates have been detected in soils and groundwater at the site. Surface water flow from this portion of the parcel would ultimately discharge to the Hylebos (Outfall No. 848, between the City's Steam Plant No. 2 and Taylor Way Properties). Groundwater in the sands and silts material also flows toward the Hylebos.

We have attributed modest release magnitudes of multiple contaminants from parcel 8 and minimal releases of contaminants, some of which are at elevated concentrations, from parcels 10a and 27. The RM score for the steam plant on parcel 8 takes into account the sporadic operations of the facility.

City of Tacoma Storm Drain Utilities, a second round cash-out party, has had responsibility for installing and maintaining storm drains for the past 38 years. It succeeded the City Department of Public Works. We have based the investigation cost analysis on a start date of 1960. A 1955 plan³⁰ describes existing sewage collection systems as including a combined sewer line extending from the intersection of Taylor Way and Eleventh Street to the Hylebos Waterway where the line discharged. Because Outfall 78 is in the vicinity and, according to the disclosure response, was constructed in 1946, it is assumed to be the discharge described in the report. Of the City's remaining twenty outfalls to the Hylebos, twelve were constructed in the 1960's or later. The City of Tacoma's NPDES Permit for Municipal Stormwater Discharges was issued on July 5, 1995.

WDOE's May 1992 Commencement Bay Nearshore / Tideflats Mouth of Hylebos Waterway Source Control Status Report: Milestone 1 indicates that the City of Tacoma storm drains were removed from List 2 (Probable Sources). Two major drains were sampled and problem chemicals were not identified. Sites were removed from List 2 after sampling or further investigation determined that they do not appear to be ongoing sources of problem chemicals to the Mouth or Head of the Hylebos.³¹ WDOE's May 1993 Commencement Bay Nearshore / Tideflats Head of Hylebos Waterway Source Control Status Report: Milestone 1 indicates that the City of Tacoma storm drains (multiple locations, including Morningside Ditch) are included on List 2 (Probable Sources). The report states that average particulate data for Morningside Drain and other city drains show no exceedances of the CB/NT SQOs for Hylebos. The City storm drains are not included on List 3 (Confirmed Sources).³²

³⁰ 1955 Development Plan for the Port of Tacoma Industrial District CTGPAC0073.

³¹ CTG0180071, CTG0180074.

³² CTG0180008.

Street wastes, which include solids collected during maintenance of stormwater catch basins, commonly contain petroleum hydrocarbons, PAHs, and lead.³³ Contaminants found in catch basin solids may include oil and grease, metals, sediment, and discarded products such as radiator fluids, paints, solvents, and construction materials. *Ibid.* City storm sewer catch basins generally indicate metals and PAHs as the most significant contaminants. The extent to which the City actively maintains the sewers can influence concentrations released into the Waterway. The volume of stormwater discharges from street runoff is significant. However, evidence of elevated levels of contamination is uncertain. We have attributed a modest release of these contaminants to the City from storm sewers. We have taken into account that the City, in maintaining streets and storm sewers, acts as a public authority, not a private, for-profit operation.

Coski, Bernard owned and **Coski Waste Disposal** operated on parcel 75 for about 18 years. A 1976 solid waste permit application describes the types of waste to be disposed as including tires, building salvage, paper, cement, dirt, and gravel. Information indicates that kraft mill solid waste from St. Regis, construction "leftovers", clay filter material from U.S. Oil of Tacoma, wood waste, paints, pesticides (including DDT), "Poligen sludge" from Lilyblad Petroleum (waste soil), and auto fluff were also disposed on site. A 1983 Ecology inspection report indicates that auto fluff and wood seemed to account for the largest volume of waste. As of 1984, Coski's activities included scaling of trucks, heavy equipment storage, and operation of business offices, repair shops and storage buildings. Coski was ordered to cease and desist all dumping in 1984. However, dumping of materials, including auto fluff from General Metals, continued for about two years. In 1986, Coski was applying quarry wastes (e.g., clay, sand, gravel) to form a cap over the buried wastes.

An Ecology analysis of a representative sample of General Metals' auto fluff deposited at the Coski Landfill detected extremely high levels of copper (74,000 ppm). A Preliminary Assessment of the site indicated that surface water samples did not indicate elevated levels of toxic chemicals. However, the Lilyblad sludge is described as containing TCE, PCE, and chloroform. The clay filter material may be a source of PNAs (polynuclear aromatics). Phthalate compounds were detected in sediment and soil samples collected from dark brown leachate emerging from the hillside. Phthalates were thought to be breakdown products from the auto fluff. PCBs and dibenzofurans were also detected in the leachate samples.

Site drainage consists of surface runoff and percolation emerging as springs to an unnamed creek that discharges to the Hylebos Waterway. As of 1982, drainage was flowing down the ravine to the back of the Manke Lumber yard, and through the Morningside Drain to the Hylebos Waterway.

Sediments samples collected from the catchment area behind Manke Lumber did not contain detectable levels of BNA, VOA, PCBs, phenolics, or priority pollutant metals.

³³ Best Management Practices (BMPs) For Management and Disposal of Street Wastes (DRAFT)" (July 1995), Washington State Dept. of Ecology.

We have attributed modest releases of VOCs (Lilyblad sludge, paints), PAHs (clay oil filter), metals (auto fluff), PCBs (auto fluff), phthalates (auto fluff), and pesticides (can of DDT) from this parcel.

Dunlap Towing, a second round cash-out party, operated a log towing facility on parcel 26 for 4 years. Dunlap operations involved towing raw Portac / West Coast Lumber Mills logs. Logs were unloaded, graded, sorted, tagged, banded, dumped and rafted. Rafted logs were removed from the water, using a diesel electric log stacker, and loaded on trucks to be taken to the Portac mill. Hydraulic equipment included a log stacker and a 966A. Petroleum products used by Dunlap included lube oil, hydraulic oil, and diesel fuel. Dunlap refueled their diesel equipment directly from a delivery truck. Lube and hydraulic oils were stored in drums. Some used oil was sent to Petroleum Reclaiming, located on Parcel 27. At least 1,100 tons of slag was placed on the site between December 1979 and May 1980, during Dunlap's tenancy.

Dunlap notes that the only contaminant which might be linked to the parcel is arsenic. None of the other contaminants with SQOEs in the vicinity of the parcel were detected in surface water, soil, or sediments sampled on site or at the discharge to the Hylebos. While Phenol and 4-methyl phenol have been potentially associated with the site, pentachlorophenol was the only phenol detected. PAHs may have been associated with fuels and oil used in the equipment during the time the parcel was used as a log sort yard. Phenols and organic by-products are associated with degradation of wood waste material, not slag.

We have attributed to Dunlap modest amounts of releases of phenols and PAHs.

Dupont Chemical owned and/or operated on parcel 21 for about 4.5 years. DuPont acquired the Latimer-Goodwin Chemical Company's (L-GCC) lead arsenate business on April 26, 1944 and continued operations until 1946. L-GCC (Not an Exhibit D party) previously operated on the site for approximately 19 years. We have not allocated to Dupont for the years during which L-GCC operated since we did not review the details of the acquisition. However, we did include an investigation cost share for L-GCC.

Metals and PAHs are associated with this parcel. In 1990 high concentrations of metals (lead and arsenic) and PAHs were detected in soils and water drainage ditches surrounding a storage warehouse building. During this time period, drainage from these ditches ultimately discharged to the Blair Waterway.

There is no information in the record on historical releases or pathways prior to 1972. It is not clear from available aerial photographs dating back to June 1962 whether surface flow during this time period would drain north to the Hylebos Waterway or south to the Blair Waterway. An aerial photograph from June 1960 shows that the Blair Waterway had not yet been extended to Lincoln Avenue. Therefore, surface flow from the parcel could have flowed to the Hylebos Waterway prior to June 1960.

There is no sampling data of media on the parcel prior to 1990. Prior to 1960, when there was a potential for surface flow from the parcel to the Hylebos, L-GCC and DuPont manufactured lead arsenate. L-GCC manufactured the product for approximately 19 years while

DuPont manufactured the product for only two years. Reportedly, millions of gallons of agricultural chemicals were warehoused at the facility. Chemicals used by L-GCC included pig lead, arsenic, and acids. Oils were used in the operations. We have assumed that operations remained generally the same during DuPont's ownership. We have assumed that there was a potential for releases of metals and oil-related compounds, which were used in the manufacturing process and operations, to have been released to the Hylebos via surface water runoff during L-GCC and DuPont's operations. We have assumed that there were process discharges from this operation, but given the uncertainty concerning the pathway, we have assumed only a modest release of the metals and PAHs to the Hylebos.

Echo Lumber, a second round cash-out party, operated on parcel 26 for 2 years. Echo Lumber operations involved wood handling, including barking and chipping logs. Stackers, barkers, and chippers were used in the operation, as well as log trucks and chip trucks. Echo Lumber refueled their diesel equipment on a daily basis directly from a delivery truck. Drums of motor oil and hydraulic fluid were maintained on site. A 1986 WDOE inspection noted an apparent fuel oil spill near the western boundary. There may have been incidental leaking from equipment but Echo was unaware of any spills. Echo Lumber does not believe any Asarco slag was placed on the site during its tenancy. Rock fill material was brought by B&L Trucking. There were no wastewater discharges during the time Echo Lumber operated on the parcel. We have assumed modest releases of PAHs and woodwaste (phenols) from this yard.

Elf Atochem has operated on parcel 25 for 71 years. Elf Atochem N.A. or its predecessors has owned the property and conducted operations on it since about 1927. The facility produced chlorine and caustic soda from 1927 until approximately 1994. Penite, a sodium arsenite pesticide, was manufactured from about 1940 until 1972. Hydrochloric acid production began around 1950 and continued until 1994. Sodium chlorate production began in approximately 1975 and was still in operation in 1994. Pennwalt's Agricultural Division operated a R&D laboratory on parcel 25a, across the street (Taylor Way) from parcel 25. In addition to production activities parcel 25 also was used for the storage, repackaging and distribution of products manufactured at other Pennwalt plants, including DDT.

Chlorine was produced in an electrochemical process whereby a brine solution is fed into electrolytic cells where an electric current is introduced. Electrolytic cells consisted of a closed container divided by an asbestos membrane or diaphragm. There are two electrodes in each cell. The anode is made of carbon and the cathode is made of steel. Lead was used in the Gibbs cell anodes. It was covered with a fuel oil and clay "gunk" to keep it from oxidizing. Cell putty was used to contain the molten lead. When a direct current is impressed across the electrodes, the negatively charged chlorine is attracted to the anode and the sodium is attracted to the cathode. Chlorine and hydrogen leave the cells as a gas and sodium hydroxide leaves the cell as a liquid. Gaseous chlorine is dried, compressed, and chilled to form liquid chlorine, which is then shipped from the plant. Sulfuric acid is used to remove moisture from the chlorine. When the acid concentration becomes substantially reduced, the acid is shipped back to the supplier. Hydrogen was cooled, compressed, and disposed by selling or burning³⁴ or it was combined with chlorine

³⁴ Around 1981, the Pennwalt plant installed a hydrogen boiler that used hydrogen from the chlorine and chlorate plants to provide heating. Sufficient hydrogen was produced to make the plant virtually independent of fossil fuels.

gas to form hydrochloric acid. Cell wash containing particulate asbestos was flushed into the on-site Asbestos Pond until 1985. The chlorine scrubbers generated a waste stream of impurities and liquid chlorine that was disposed on-site in Taylor Lake. By-products included chlorinated ethenes and other chlorinated hydrocarbons. A former employee who recalled analyzing the scrubber "gunk" indicated that hexachlorobutadiene was not detected in the gunk. He recalled chloroacetaldehyde and small amounts of chloroform were detected. Pennwalt's 1975 Solid Waste Disposal plan indicates that approximately 36 tons per year of solvent and solvent residue, including organic material removed from the chlorine stream in a purification system, was disposed in a disposal lagoon on company property. The "solvent" may have been the material from the chlorine scrubber. The conversion from graphite anodes to titanium anodes in 1975 reduced the generation of these by-products. Taylor Lake was not used for condensate disposal after 1981. The on-site disposal facility known as Waggoner's Wallow was used for the disposal of caustic that had been used for absorbing waste chlorine scrubber liquor.

Sodium hydroxide cell liquor from the electrolytic cells was pumped from the cells to storage tanks, conveyed to evaporators, and then shipped from the plant. Wastes included off-spec product and sludges from corrosion of vessels.

Hydrochloric acid was produced by burning hydrogen gas in an atmosphere of chlorine. It was shipped from the plant and used for neutralization of the plant's wastewater.

The sodium chlorate process began in approximately 1975. Sodium dichromate is used as a corrosion inhibitor and to improve the electrical efficiency of the chlorate cells. Wastewater from the chlorate process is stored in tanks. Supernatant is returned to the process and sludge is treated to remove chromium. Recovered chromium is recycled back into the process and the sludge is disposed off site. A trichloroethane solution was used to remove iron and iron oxide from process cells. The solvent was contained in parts degreasers, installed as part of the chlorate process. It appears that in the early period of production, chlorate wastes were disposed on site in the "Chlorate Pond." There have been several spills of sodium chlorate that resulted in the release of hexavalent chromium to the outfall.

Pennwalt manufactured Penite, an arsenical pesticide, from 1940 to 1972. Raw materials included arsenic trioxide, at least some of which was obtained from the Asarco smelter, and sodium hydroxide. The product was filtered through diatomaceous earth ("DE") and drummed. Spent DE filter was disposed on site in one of the Penite waste lagoons. The Penite disposal area is comprised of three separate ponds and one burial pit. Wastes disposed included Penite sludges, pipes containing Penite sludge, drums of plant wastes, and drums of waste from the Agricultural Chemicals operation. The arsenic trioxide used in the process may have contained trace amounts of antimony, copper, iron, lead, and mercury. Some sodium arsenite was released to the environment via leaky valves and fittings.

A newspaper article indicated that a DDT process was to be installed at Tacoma. Whether or not that occurred is not known at this time. There is evidence that DDT produced at Pennwalt's Portland plant was stored in the warehouse in Tacoma. Liquid formulations were stored in steel drums and wettable powders. Dusts were packaged in paper bags. A former employee recalled there was a floor drain in the warehouse.

Benzene hexachloride may have been shipped to the Tacoma plant prior to distribution. Testimony varies with respect to whether ammonia was ever produced at the plant.

The Taylor Lake Area was an approximately 3-acre area containing five small ponds, two drainage moats, and a waste pile. The Chlorate Pond received brine sludge and graphite waste from 1967 to the mid 1970s. Waste sodium chlorate and dichromate corrosion inhibitor were disposed there from 1978 to 1979. The West Taylor Lake Extension contained waste sludge from the chlorine process, including chlorinated organics. The Asbestos Pond received wash water containing asbestos from an unknown date until 1981. Taylor Lake received calcium carbonate and magnesium hydroxide brine sludges. Chlorine condensate and brine muds were disposed in the Cell Room Pond until at least November 1981. Leachate from Taylor Lake collected in the Recycle Moat and was pumped back to Taylor Lake or the Cell Room Pond. Leachate and stormwater runoff collected in the Storm Runoff Moat. Another waste area was the spent sand blasting grit waste pile found on site around the sandblasting shed between Taylor Lake and the Hylebos.

Halogenated and polycyclic aromatic hydrocarbons were detected in the Taylor Lake area in 1982 and 1983.

Bunker C oil was the primary fuel used at the plant until it converted to natural gas. In the early 1970s, fuel oil was stored in three large aboveground tanks located near the waterway. The tanks were in a diked area. Prior to Bunker C, the tanks had contained food grade caustic. They were slated for removal in 1990.

Currently there is no known information indicating that there were leaks or spills of transformer oil. The transformer area had a concrete pad and a curb. Pennwalt's 104(e) response indicates that trace (> 1 ppm, < 50 ppm) quantities of PCBs have been found in used transformer oil and there was no reason to believe PCBs were deposited in the Hylebos as a result of their operations. Historically, PCBs were used as pesticide extenders. However, I am not aware of any evidence indicating whether or not they were used as such at the Pennwalt plant.

The plant used mercury arc rectifiers to rectify the current for cell room operations. The rectifiers were located in their own building. According to a former employee, great care was taken not to spill any mercury during maintenance of the rectifier pots. The rectifiers were used until about 1975.

Pesticides from Pennwalt's Agricultural Chemicals Division were buried in the Penite disposal area. The bottles were punctured to allow the pesticides to migrate into the "soil water system." No waste disposal in these pits occurred after 1956 or 1957 when, after a "housecleaning" of the laboratory, parathion and malathion wastes were buried in the Penite pit. Due to the alkaline nature of the soil, the pesticides were expected to break down rapidly.

Pathways

Until the mid-1960's, the Hylebos Waterway terminated at the Pennwalt plant.

Aerial photographs taken in 1946 depict a discharge from the Penite building to the Hylebos. Later photographs suggest that the piping had been disconnected by 1955. Penite waste may have been directed to the lagoons after the piping was disconnected.

Prior to 1957, there were three major sewers from the plant with a total discharge of approximately 9.5 MGD. Calcium and magnesium sludges from the salt purification unit were discharged through one of the sewers. In 1957, Pennwalt constructed an interceptor sewer to combine the discharges from the three sewers. Sludge thickening equipment was to be installed and sludge would be disposed in lagoons on the property. Sanitary discharges were connected to the municipal sewer system in the early 1970s. In 1971, the wastewater discharge included cooling water used to condense caustic-chlorine gas from returned railcars, water used to cool chlorine as it was loaded into tankers, cooling water-chlorine mixture from the production process, and domestic waste.

In 1972, the industrial wastewater discharge included leaks and spills from electrolytic cells, condenser water, scrubber water, contact chlorine cooling water, acid plant spillage, tank car and cylinder wash water, wet weather overflow of brine purification sludge pond, non-contact cooling water, and boiler blowdown. Untreated stormwater was combined with the industrial wastewater and both were being discharged from the same outfall.

There were six discharges from the plant in 1981. In addition to the main plant sewer, there was a west sewer, east sewer, west seep, east seep, and east drainage ditch.³⁵ Process wastewater flows were approximately 11.86 MGD and total discharges (including seeps) were approximately 11.94 MGD. Groundwater was entering some of the process sewers and being discharged to the waterway. Some time between 1984 and 1989, Pennwalt sealed the storm sewers to reduce migration of arsenic from the Penite area to the Hylebos. Additionally, all stormwater flows were routed to the main outfall for treatment.

TetraTech's 1985 investigation of the CBN/T indicated that groundwater contamination with chlorinated organics was the result of past, rather than present, practices. A 1987 preliminary assessment indicates that the primary contaminants found in groundwater beneath the site include arsenic, chromium, chloroform, and cyanide. Organic contaminants such as carbon tetrachloride, tetrachloroethylene, and dichlorobromomethane were detected in several monitoring wells. Other contaminants, such as chlorinated ethanes, tetrachlorobutadiene, phenol and toluene, were detected in the groundwater but were not attributed to particular on-site waste streams.

In 1987, Pennwalt entered into a consent decree with WDOE regarding groundwater contamination. A second consent decree addressed potential arsenic migration from the plant site to the Hylebos. Although the consent decree focused on arsenic, the investigation identified

³⁵ The east drainage ditch is located on the property line between the Pennwalt plant and the adjacent log yard (Parcel 26).

VOC (chloroform, PCE, methylene chloride, acetone) contamination of soil and groundwater. Penite wastes were removed from the waste pits in 1990 or 1991. Around the same time, sheet piling was to be installed to stop groundwater migration into the Hylebos.

Investigation Costs Impact

Contaminants potentially associated with operations on this parcel include: arsenic (Penite waste, sandblast grit), chromium (sodium chlorate waste, spills), lead (from waste anodes), mercury (from rectifiers), organics (from the chlorine process and solvents), PAHs (fuel oil), and pesticides (DDT stored in warehouse, wastes buried on site). Copper and zinc were detected at elevated concentrations near outfalls to the Hylebos. PCBs also have been detected at elevated concentrations in proximate subtidal sampling stations. Specific sources of these contaminants have not been identified.

Arsenic: The disposal of sodium arsenite wastes in pits on site resulted in contamination of groundwater at the site. Contaminated groundwater was released to the Hylebos via infiltration of the sewers and via seeps in the shoreline. Surface runoff also was identified as a pathway to the Hylebos. Historically, Penite wastewater was discharged directly to the Hylebos until approximately the 1950's. Although spent blasting sands from Asarco were located on site, they were not considered to be a significant source of arsenic. Data from sediment cores demonstrate that significant contributions of arsenic occurred prior to the introduction of slag as log yard ballast in 1975. Virtually 100% of the arsenic from Pennwalt was in soluble form, while about 62% of arsenic from log sort yards was in soluble form.

A consultant suggests that arsenic released from the pesticide wastes disposed on site is more bioavailable than arsenic from Asarco slag. Since the Penite waste was produced from a high pH dissolution process, arsenic would remain soluble and eventually reach the waterway via groundwater seeps. Arsenic concentrations in groundwater at the site have been as high as 190,000 mg/l. The pH decrease in the waterway water column would cause significant adsorption of arsenic onto sediment particles.

Chromium: The inactive chlorate pond was identified as a source of chromium contamination in groundwater. Similar to arsenic, chromium was released via contaminated groundwater infiltrating the sewer and seeping from the banks into the Hylebos.

Other Metals: Copper, lead, mercury and zinc were detected at levels considerably above background. The highest levels occurred below the west seep, east storm sewer, and by the diffuser.

Organics: Chlorinated organics were produced as by-products of the chlorine process and were disposed in on-site lagoons. Hexachlorobutadiene was detected in the east seep sediment. Carbon tetrachloride, tetrachloroethylene, methyl chloride, dichlorobromomethane, and chlorodibromomethane were thought to be by-products

associated with chloroform.³⁶ Chloroform pathways include groundwater, seeps, sewers, and surface runoff. Concentrations were highest in the east sewer and two seeps. Chlorinated ethanes, hexachlorobutadiene, phenol, bis(2-ethylhexyl)phthalate, and toluene were not attributable to one definable waste stream but may have been associated with solvents or degreasing agents periodically discharged to the lagoons. Concentrations of these contaminants were highest in the east and west seeps.

PAHs: PAHs may have been released to the Hylebos from leaks or spills from the Bunker C fuel oil tanks located near the waterway. Spills may have occurred during loading or unloading. PAH releases also are associated with use of carbon anodes at the plant.

Pesticides: Pesticides may have been released to the Hylebos from Penite waste pits or from leaks or spills that reached the sewer. Any spills of DDT may have reached the waterway via the floor drain in the warehouse. DDT and its metabolites (lindane and aldrin) were detected at high concentrations in the west seep and east storm sewer. Lower concentrations of DDT were detected in the west sewer. Neither DDT nor insecticides were detected in groundwater samples at the site. DDT was stored in the plant's resale warehouse for shipment and distribution to area customers.

PCBs: PCBs have been detected in intertidal sediments along parcel 25 and in proximate subtidal locations. Releases of PCBs from the facility have not been documented from publicly available sources. Significant use of electrical transformers and rectifiers has been documented.

According to Buffelen, this parcel is a potential source of *n*-nitrosodiphenylamine. Two intertidal stations in front of Parcel 25 are contaminated with this chemical. Buffelen states that, because Elf is not participating in the allocation process, it is difficult to determine which activities may have contributed this contaminant.

We have attributed to the plant a major release magnitude during Penite manufacturing and a significant release magnitude during non-Penite manufacturing operation periods. We conclude that the plant is a source of elevated levels of a number of contaminants to the Hylebos. For purpose of calculating the investigation cost share, we have applied a higher RM and SQO score during the time that the plant was involved in Penite production.

Elf also has been attributed an owner share for log yard operations on Parcel 26.

Executive Bark has been associated with parcel 76 since 1985. William Fjetland, who is associated with both B&L Trucking and Executive Bark, purchased the property in 1977 or 1978 for the purpose of hauling and dumping approximately 300,000 cubic yards of log yard waste. Executive Bark acquired the property in 1985 after it was closed for dumping purposes. We understand that the disposal area was remediated in about 1994. We have associated Executive

³⁶ Chloroform was generated in the old graphite cells by the reaction of linseed oil and chlorine.

Bark with the parcel for 10 years, in order to take into account the fact that the remediation was accomplished in 1994.

The majority of material disposed was wood waste from log yards in the Tacoma area. The log yard waste contained wood waste, primarily bark, yard soils, and gravel-sized rock, including Asarco copper smelting slag used as ballast. In 1980, auto fluff and bentonite slurry were also disposed at the site. The site was closed in 1984 for accepting wood waste without a valid solid waste disposal permit. The final cleanup plan for the site estimates that 97-98% of the waste at the site is debris and 2-3% is auto fluff.

From 1985 to the present, Executive Bark conducted bark cleaning operations at this location. The bark is cleaned with a washing machine that consists of a big round screen that filters out the fine bark particles. The bark is then put into a hammer mill via a conveyor.

Fjetland was issued a unilateral order in 1987. In 1991, WDOE issued an enforcement order to Executive Bark, Asarco and Murray Pacific. The order requires preparation of a final cleanup design.

Soils, sediments, surface water and groundwater on the site are contaminated with arsenic. In 1993, WDOE performed additional sampling to determine whether the Hylebos Creek and Fife Ditch were sources of arsenic contamination of the waterway. Exceedances were detected in sampling stations near Parcel 76. WDOE concluded that, because there are no arsenic SQO exceedance trends throughout the Hylebos Creek and Fife Ditch, it does not appear that either is a contributing source of arsenic contamination of the Hylebos sediments.

Chemicals of concern are heavy metals (leached from slag and contaminated wood waste and soils) and organic compounds (benzoic acid and phenols). Antimony, arsenic, cadmium, chromium, copper, lead, nickel, and zinc, as well as iron are all metals associated with slag and have been detected at elevated concentrations in local groundwater. Benzoic acid and phenols have been detected in landfill leachate and groundwater. These compounds are indicative of the degradation of wood wastes. Low levels of toluene, acetone, and naphthalene were also detected in isolated landfill soil / fill samples.

We have attributed minimal releases of various contaminants during Executive Bark's association with the site.

F.O.F., Inc. (f/k/a F.O. Fletcher, Inc.), a second round cash-out party, is considered to be an owner and operator of a petroleum distribution and marketing facility on parcel 3 for 35 years. Parcel 3 was owned and operated by Fletcher Oil Company, beginning in 1933. F.O.F. Inc. (FOF) was not formed until 1948. In 1948, one of the partners in Fletcher Oil Company transferred his interest to FOF. When the Fletcher Oil Company partnership dissolved in 1967, FOF acquired title to the property and continued to operate the business. Although FOF was not created until 1948, as a partner in Fletcher Oil Company, it is likely that it would be liable for the liabilities of the partnership, extending back to 1933, when Fletcher Oil Company commenced operations. However, since I have not evaluated successor or other contractual issues as part of

this allocation, I have only considered FOF's involvement from the time it came into existence, 1948.³⁷

FOF also leased tanks on parcel 4 for 9 years. F.O. Fletcher leased space in a building on parcel 5 from May of 1972 to 1980. The building was used as an office and bookkeeping facility. No petroleum products were handled or stored on this parcel.

United Independent Oil Company, a lessee, operated a tetra ethyl lead (TEL) plant for two years at the most. Operations began in 1976 or 1977. The TEL plant was built under the supervision of Ethyl Corporation. F.O. Fletcher originally had about a twenty-five percent (and later thirty percent) shareholder interest in United Independent Oil, along with three other companies. F.O. Fletcher's lease with United Independent Oil was terminated in December of 1978 or January 1979. PRI took over operations in mid-1982 and operated the plant for less than one year.

Potential releases of metals and petroleum-related compounds, are associated with activities on this parcel from historical cleaning of tank condensate and residual product discharged to the ground, and spills associated with the operation of the fuel storage and distribution facility and TEL plant. Lead has been detected in the subsurface soil located directly beneath the underground leaded wastes tank and in groundwater from the tank excavation pit. Lesser concentrations of lead in groundwater and soils were observed in a plume surrounding the underground tank.

Based on an undated site tank diagram apparently found on a door in an office on the property, we have noted the possibility that waste oil, or "slop" was stored in tanks on the property, although it has been denied by witnesses for FOF and PRI. If waste oils were stored, and if any releases occurred therefrom, it could expand the contaminants associated with this parcel. PCBs have been sampled in the berm area of a tank pit on the property. However, there is no evident pathway that would facilitate migration of PCBs from the area in which the PCBs were detected to the Hylebos. Thus, we have not attributed PCBs to operations on this parcel.

Organics (tetrachloroethene), metals, and petroleum-related organic compounds (toluene, ethyl benzene, and benzene) have been detected in the groundwater underlying the site. Tetrachloroethene has also been detected in the bank seep water. The chlorinated organics may be the result of a site activity, such as tank cleaning, or may represent migration from an off-site source. Whether a pathway from the groundwater underlying the site to the Hylebos Waterway exists is still in dispute. In addition, it is not clear whether groundwater from Occidental's plant (the adjacent parcel 2) is flowing onto this parcel, or vice versa.

Potential releases of organics and metals are also associated with the fill material found along the bank of the waterway. The fill material, soil along the bank, and the groundwater seep contains organics and metals. The fill material appears to contain material (e.g., graphite anodes) that exhibits similarities with Occidental's waste. It appears from aerial photographs, that a berm

³⁷ We have included an investigation and remediation cost share for Fletcher Oil Company (a non-Exhibit D party) for the years 1933-1947.

was extended from parcel 2 along parcel 3 from about 1960 through 1974. Every indication is that the fill material forming the berm is from Occidental. I am unaware of any evidence that FOF, the owner of parcel 3, added any materials to the berm, although the existence of petroleum hydrocarbons in the berm suggests that possibility, as do aerial photographs.

While, for the purpose of investigation cost analysis, we attribute the possibility of lead releases to the tetra ethyl lead (TEL) plant on parcel 3, we note that the berm source material also contains elevated lead concentrations, as do intertidal areas along parcel 2. This indicates that the fill material from Occidental plant at parcel 2 is a more significant source of lead than the TEL plant.

Independent investigations, by PRI and Occidental, of soil and groundwater quality have been conducted between 1979 and 1995. The studies have not conclusively identified the sources for contamination found in the soil and groundwater on the site. In 1995 the DOE and EPA concluded that the potential sources had not yet been adequately characterized, and additional investigations were conducted.

PRI's consultant contends that the chlorinated hydrocarbons detected in site soils outside the bermed area in deeper soil samples obtained near the groundwater table or below suggests an upgradient source. The consultant notes that no chlorinated hydrocarbons have been detected in shallow soils outside the fill-debris berm.

Occidental's consultant concluded that the contaminants that have been detected in the groundwater are present at the highest concentrations on the PRI property.

We interpret groundwater sampling data to demonstrate that groundwater is not extending from parcel 3 directly into the Hylebos. However, there appears to be a possible groundwater flow from parcel 3 towards parcel 4, and, ultimately towards the Hylebos from parcel 4. Thus, we assume the possibility that contaminated groundwater from parcel 3 operations may have reached the Hylebos. We note that the groundwater flow beneath parcel 4 has not been characterized. We also note that the groundwater flow may have changed over time due to site conditions, such as the presence or absence of pavement.

The surface runoff pathway for parcel 3 is limited, due to extensive berms around tanks, and the shoreline berm that has been in place for many years. A possible groundwater pathway from this site is still in question. For purposes of investigation costs, we have noted the potential for modest (at the low end of the range) releases of PAHs and petroleum-related organics. We also note the possibility of chlorinated organics. We have attributed a minimal release of contaminants for parcel 4.

General Metals has operated on parcel 45 for 33 years. General Metals is a possible source of auto fluff at parcels 10c, 13, 15, 68, and 68a and a confirmed source at parcels 48, 49, 50, 51, 52, 75 and 76. It appears that the Port of Tacoma owned parcel 45 prior to 1965.

The Sussmans / SRS Properties³⁸ owned the property from 1965 until 1992 and leased it to General Metals of Tacoma for that period of time. The Sussmans owned the majority of General Metals' stock until February 1981, when they sold all of it to Acme Trading. After the stock sale, the Sussmans' only involvement with the site was as landlords. General Metals purchased the property in 1992 and continued its operations. Available information also indicates that Universal Metal Products operated on the parcel from 1970 to 1975.

This site has been used for ferrous scrap metal recycling (1965-present) and for log staging and loading (1965-1981). Facilities have included a shredder, cranes, rail line, a hydraulic shear (since 1970), railcar incinerator (installed circa 1970-1973), ship breaking (began circa 1972-75), a maintenance shop (since 1978), and a briquettor (since before 1983). Operations include the purchase, preparation, processing, storage, and shipment of ferrous scrap metal, including junk car bodies, engines, transformers, railroad cars and rails, tanks, appliances, cable, and sheet metal. The shredding operation produced a principally non-metallic "fluff" consisting of upholstery foam, glass, fiberglass, plastic, vinyl, wood, and residuals of petroleum and other liquids. Steel turnings, some containing oil, were hydraulically compressed in the briquettor. There was no equipment to catch any oil that may have been released.

From approximately 1982 through 1985, General Metals purchased empty transformer cans and transformer cores. Although oil had been pumped from the transformers, they were not rinsed before being brought to the site. Transformers were brought to the site at least daily. There were spills of transformer oil and some leaked from the cores onto the soil at the site. In 1987, several PCB and PCB-contaminated operational transformers were leaking. In 1990, a consultant estimated that there were approximately 20-50,000 cubic yards of PCB-contaminated soils on the site.

Some scrap metal fell into the waterway while being loaded onto or off of ships. One load of Asarco slag was used as fill behind the dock and is also distributed on other areas of the property, including under the railways. Wood products, such as pulp mill liquor, were disposed on site prior to 1981. Deposition testimony indicates that the effect of General Metals air emissions (e.g., from rail car burning) on sediment contamination was negligible. In 1969, a ship docked at General Metals reportedly released ballast water resulting in a brownish scum, a rainbow oil slick, and some spots of heavy, thick dark oil.

Stormwater samples collected in 1986 and 1987 exhibited elevated concentrations of metals and organics. As of 1988, an oil / water separator was the only mechanism used to treat stormwater. By 1993, a stormwater collection and treatment system, including a 230,000-gallon equalization tank with oil skimming and chemical flocculation, had been installed. The system also provided for pH control and sludge treatment.

³⁸ SRS Properties, Inc., Leslie Sussman, and General Metals of Tacoma, Inc. are all listed on Exhibit D. Acme Trading and Universal Metal Products are not listed on the exhibit.

Site capping, installation of a stormwater collection system, development of a plan to minimize hazardous substances releases, and groundwater monitoring were all required by a 1991 MTCA consent decree.

Potential contaminant sources have included surface contamination with oil and petroleum products, steam cleaning operations (eliminated by 1988), and PCB-containing transformers and contaminated pads. Contaminants of concern included heavy metals, oil and grease, and PCBs. PAHs also may have been generated from operations such as burning wood railcars and disposal of ash on the site.

Pathways

In 1988, the drainage system consisted of a catch basin draining to Marine View Drive, a collection system directed to an oil / water separator and then to the Hylebos, a collection system reportedly filled with concrete, and another collection system directed to the Hylebos. Surface runoff also flowed from perimeter locations toward Marine View Drive and the Hylebos. Uncontrolled surface water discharged to the Hylebos via the graving slip and some points adjacent to the bulkhead. Stormwater discharged to Marine View Drive flows along the ditch and is ultimately discharged to the Hylebos. By 1990, stormwater from the area southeast of the shredder was being directed to two storage tanks (6,500 gallons and 13,000 gallons). After settling, water was pumped to the shredder for cooling or dust control. A 1995 drainage map depicts three stormwater outfalls to the waterway from this parcel.

Contaminants are transported to the Hylebos via shallow groundwater beneath the site. A 1990 study indicated copper and nickel as primary COCs for shallow groundwater.

Sussman cites various reports and deposition testimony for the proposition that contamination on the General Metals parcel stems from disposal on the property of dredge spoils that were contaminated by Olin and Kaiser plant operations. However, Olin presented data on the location and placement of fill material during the extension of the Hylebos in 1960 and later, and it appears that most fill material on the General Metals site did not come from the areas of the Tideflats that received runoff from Olin and Kaiser Plant operations. The nature and history of the site operations and the sampling data on the property also undermine the theory advanced by Sussman.

Investigation Costs Impact

Contaminants potentially associated with operations on this parcel include: PCBs (leaking transformers, scrap transformers, auto fluff and ship dismantling), metals such as arsenic, copper, and zinc (slag, metal scrap), PAHs (oils from transformers, steel turnings, ship dismantling, leaks and spills), phenols (wood waste), phthalates (decomposition of plastics in auto fluff) and TBT (hull paint). Sample stations located in the vicinity of this parcel include 1102S, HY-23, 2110S, 2210I, 2115S, 2116S, 2211I, HY-22, 2108S, 2212I, and 2213I.

We have attributed a major release of a number of contaminants from operations on parcel 45 and minimal-to-modest releases of metals and PCBs from various parcels where auto fluff was dumped.

Grice Landfill operated on parcel 79 for about 12 years. This parcel is situated on the bluffs above Marine View Drive. It does not have waterfront access to the Hylebos Waterway.

This parcel was owned by Ernest Grice and used for solid waste disposal. In 1984, the City initiated enforcement action against Grice for operating an illegal landfill. The two parties reached an agreement for Grice to continue operating for five years. In 1987, the City ordered Grice to cease all dumping activity except for clean fill and to submit plans for closing the facility. That same year, demolition debris and yard debris were found to have been disposed at the site without the City's approval and part of the landfill was on fire. A WDOE memo indicates that the fire may have caused the release of organics from creosote or painted debris. The landfill was smoldering in the summer of 1989. A 1989 WDOE report indicates that the site owner was bankrupt and the City had accepted responsibility for the site.

Waste disposed at the site includes wood, concrete, and a small amount of domestic garbage. No leachate stream was noted in 1987 or in 1992. A 1992 UBAT memo states that it is doubtful that contaminants reach the Hylebos from the Grice Landfill. We have inferred a minimal release of organics from this parcel.

Howard, Donna owned parcel 73 for 25 years. Parcel 73 is located at 6713 Pacific Highway East, approximately one mile southeast of the Hylebos Waterway. It does not have waterfront access.

Apparently, Western Superior Structural Manufacturing ("Western") has operated at this location since 1966. Western purchased the property from Eileen M. Campbell of the KIST Bottling Company. In 1969, Western began leasing the property from Gilbert R. Howard who bequeathed the property as a gift to Donna Howard in 1973. The Howard family is the stockholder of Western Engineering.

See the description of Western Superior's operations below.

Ms. Howard has been attributed an owner share that takes into consideration the interest of the Howard family in the operations of Western Engineering.

Hylebos Marina, a second round cash-out party, has operated on parcels 49, 50 and 51 for 15 years. Hylebos Marina has operated a marina and boatyard since 1983. Operations include sanding, painting, woodwork, fiberglass repair, and prop and shaft work. Individual boat owners perform hull and bottom painting, zinc replacement, and prop and shaft work. More recently, some owners have been re-fiberglassing their boats using resin, hardener, and cloth. Acetone may be used to clean up. The only paint stored on site is a one-gallon can used on Ron Oline's boat. During an inspection in 1992, blue and red bottom paint was noted on the gravel in the boat maintenance yard.

Since 1965, boats have been washed on the marina property. Over time, pressure washing became more popular than hand washing. Harbor Services provided pressure-washing services from 1982 to 1992. Since 1992, Hylebos Marina has performed pressure washing. There was never any sandblasting or spray painting allowed in the marina boat yard because of the close proximity of the boats to one another. Boats have been hand-painted with anti-fouling paints. Zinc replacement³⁹ takes place in the parking area at the Hylebos Marina. Old zincs are discarded in the garbage can.

Several types of petroleum products or oils have been used on the marina property. Such materials include hydraulic oil (for the travel lift) and motor oil, which are stored in small containers, and diesel fuel and gasoline, which are stored in portable tanks. Waste oil is stored in a 150-gallon tank in the maintenance shop. In 1992, there were several gallon jugs of waste oil sitting outside in the yard. An "old, messy oil tank" was stored outside of Harbor Services shop. A safety solvent tank and used oil collection tank were located inside the shop.

Between 1974 and 1975, a portion of Parcels 49, 50, or 51 was filled with auto fluff from General Metals.

There are four stormwater discharge pipes from the marina property to the Hylebos. Two pipes, one installed in 1983 and the other in the late 1960s, drain part of the parking lot area. The other two pipes drain the gravel boatyard and additional gravel parking area. One is a catch basin piped to the waterway and was installed in the mid-1980s. The other is a grass-lined ditch that discharges from a culvert. The ditch was created in the mid-1960s. Stormwater samples collected from the site have been found to contain elevated levels of copper.

The only wastewater discharge from Hylebos Marina's operations was generated from the washing of boat bottoms as they came out of the water for haul-out. Copper, zinc, lead and other metals are ingredients in bottom paint. The facility has been conducting haul-out operations since the mid-1960s. In February 1993, Hylebos Marina installed a closed loop recycling system for handling wastewater. Prior to the installation of the recycle system, wastewater flowed through three catch basins and discharged to the Hylebos. A 1986 analysis of boat washing water indicated elevated levels of zinc and copper.

³⁹ A piece (or pieces) of zinc is bolted on shafts and rudders to protect them from electrolysis. The zinc is subjected to electrolysis before other metals on the boat.

Part of the 1994 investigation of auto fluff disposed at 2120 Marine View Drive involved installing two monitoring wells on what appears to be Parcel 50. Groundwater is assumed to flow toward the Hylebos, although the investigation did not reveal any seeps along the exposed shoreline or bulkhead. Copper concentrations were above criteria in both upgradient and downgradient wells. Nickel, lead, zinc, and PCBs exceeded criteria in the downgradient well.

Potential contaminants originating from Marina operations include PAHs (from oil and petroleum products), metals (from bottom paints or paint chips, auto fluff), TBT (from bottom paints or paint chips), phthalates (from fiberglass repairs), and PCBs (from auto fluff). We have attributed modest releases to these activities. Metals are assumed to be at elevated concentrations. We have assumed that PCB releases are unrelated to Hylebos Marina operations.

Hylebos Properties owned parcels 11 and 12 from 1965-1970. During this time, various tenants on the site, including Sierra Sandblasting, conducted sandblasting operations on these parcels. We have attributed metals and PCB contamination to this parcel and have attributed it to each of the Exhibit D owners of these parcels, as well as the Exhibit D operators.

ITT Rayonier and its predecessors operated pulp mills on parcels 11 and 12 for about 20 years (the pulp mills did not run continuously). The record does not contain much information about these operations. Documented reports of pulp mill operations indicate that PAHs and other phenols are contaminants typically found in sediments adjacent to pulp mills. PAHs found in the sediments at this parcel have the characteristics of non-combusted petroleum.

Contaminants of concern associated with operations on this parcel include PCBs, metals, and PAHs. Soils on the property and shoreline along the Hylebos Waterway have been contaminated by metals. Material that was found during an investigation in the western bank of the ditch where it joins the waterway and a composite of material from a pile of drums revealed high levels of metals. The samples from the drummed material also contained high levels of PCBs. These contaminants have also been found in tanks, drums, and vats used in operations on the parcel. The primary migration pathway for these contaminants to the Hylebos would be via erosion of the contaminated soils. Taylor Way Properties has conducted additional research and notes that there were transformers in the northwest corner of a steam plant operating on an adjacent parcel.

We have attributed to ITT Rayonier modest releases of PAHs and phenols, since those are known to be present at pulp mills. We also have assumed that these operations were a possible source of extensive contamination of the property and included PCBs in the SQO score.

J&G Investments owned parcel 41 for 22 years. It is attributed an owner portion based on its active interest and knowledge in the operations of Jones-Goodell Shipbuilding (see discussion below).

Johnson, Judy, and Oline, Ron, second round cash-out parties have co-owned parcels 49 and 50 for 24 years. Don and Alba Oline owned the marina property from 1972 to 1975 when they deeded it to their children, Ron Oline and Judy Johnson. It appears that the children own the land

on which the Hylebos Marina operates but the entire family owns the marina business⁴⁰. We have attributed an owner share to Ms. Johnson and Mr. Oline taking into account their nexus to the business.

We have allocated to Judy Johnson and Ron Oline each a share of investigation costs. Combined, these percentages reflect their co-ownership of Parcels 49 and 50 for 24 years. The share represents an approximately 5% of the total Hylebos Marina owner/operator share and an additional .04% as a current owner of property on which auto fluff has been disposed.

Johnson-Byers (d/b/a Goodwin-Johnson) leased parcel 26 from 1967 to 1977. We have no specific information on these operations. We have assumed that it operated as a log yard and attributed to it modest releases of PAHs and phenols, similar to other log yard operations on parcel 26.

Jones Chemicals has owned parcel 48 and engaged in the manufacture of sodium hypochlorite (household bleach) and ammonium hydroxide and repackaging of acids, alkalis, chlorine, anhydrous ammonia, and sulfur dioxide since 1974. Jones is a distributor of pre-packaged products for municipal drinking water treatment, sewage treatment and swimming pool maintenance. The facility includes a warehouse, a paved loading area, a boiler house, and a containment and wastewater collection area. The drum wash area is completely bermed and sealed with a single collection sump.

Cylinders and bleach containers returned from customers are rinsed out in the yard adjacent to the bleach formulation and wastewater treatment areas. All rinse wastewater goes to a sump and is pumped to treatment tanks where it is neutralized. Cooling tower bleed-off, boiler blowdown and stormwater from the wash pad area also are neutralized before being discharged to the sanitary sewer. Jones Chemicals has operated under a pre-treatment permit since 1987. Wastewater may have been discharged to the Hylebos prior to the installation of the sanitary sewer in 1974.

As of 1993, there were four tanks located inside the treatment area: two for wastewater treatment, one for bleach storage, and one was empty and destined for scrap.

Jones repackages some materials in 150 lb., 1000 lb., and 1 ton cylinders for resale. Cylinders are refurbished before every refill. Until some time prior to 1993, refurbishing included bead blasting the valves and painting the containers. Bead blasting generated cadmium-contaminated waste that was disposed off site. As of December 1993, Jones had begun buffing the cylinders instead of sandblasting them. Cylinders were spray-painted in a booth until February 1994 when Jones began painting with rollers and brushes. Solvents (e.g., IPA, toluene, MEK, MIBK) are allowed to evaporate from painting equipment. Metal wastes generated from hydrotesting chlorine cylinders are disposed off site.

Prior to 1982, stormwater runoff from the entire site and the tank rinsing wastewater may have been untreated and discharged to the Hylebos.

⁴⁰ It appears that Ron Oline is the current owner of Hylebos Marina.

Jones Chemicals has a history of illegal discharges to the Hylebos, including intermittent releases of wash water from drum rinsing to the drainage ditch. An enforcement order was issued to correct chronic chlorine releases. In 1992, a drum containing petroleum product was leaking outside the neutralization system.

A 1991 inspection report indicates that the cylinder sludge removal and painting operations may be activities with the greatest pollution potential at this site. Sludges and cleaning wastes are neutralized in the treatment process and discharged to the sanitary sewer. Sludge solids are accumulated in the neutralization tanks. Painting generates waste aluminum paint and lacquer thinners.

A drainage ditch, which runs along the western property boundary, flows into Waywanda Creek, which flows along Marine View Drive. The Creek ultimately discharges to the Hylebos at the Morningside Drain.

Given the discharges of untreated process wastewater, we have attributed modest releases of VOCs from the solvents and paints used on site and metals from bead blasting operations to Jones Chemical.

Jones-Goodell Shipbuilding Corp. or Jones-Goodell Corporation owned and/or operated on parcel 41 for 30 years. The parcel is situated on the southeastern side of the upper turning basin at the head of the Hylebos Waterway.

Jones-Goodell was incorporated in 1976 for the purpose of custom yacht building and repair. Work is conducted in various buildings on site as well as on the dock and the boatway. Boats are pulled up the boatway and washed down prior to being painted and slipped back into the Hylebos. Garages are used for structural or fiberglass repair, painting or other modifications. Sandblasting is performed in an open shed draped with plastic. During a 1993 inspection, there was spent grit on the ground in front of the shed. Apparently, spent sandblast grit was used as fill behind the parcel's bulkhead. In 1992, the grit was identified as an ongoing source of contamination, particularly copper, to the waterway. The grit was removed by late 1992.

Raw materials used by Jones-Goodell include hydrocarbon solvents, MEK, marine coatings, polyester and polyamide resins, aluminum cleaner and gating, and fast evaporating solvent blend and reducer for epoxy primers solvent blend. Wastes generated include waste lacquer thinner. Hazardous wastes generated between 1976 and 1987 were accumulated on-site in a shed until an initial shipment of waste in August 1987.

Oily bilge water was treated as hazardous waste. It is not clear for how long this was the practice. We assume that at one time, it was discharged to the Hylebos.

In July 1991, diesel fuel was released to the Hylebos from the *Montego*. The WDOE report of the spills indicates Jones-Goodell Yachts as responsible. Reportedly, only 5 gallons of fuel reached the waterway.

Since at least 1990, Jones-Goodell has discharged process water from its pressure water (average annual = 50 gpd) to the sanitary sewer. Wash water falls to a concrete slab in the boatway and drains to a catch basin that connects to a 9,000-gallon evaporation tank located alongside the boatway. We assume that pressure wash water was discharged to the Hylebos prior to 1990. In 1990, samples taken from the evaporation basin detected methanol in the evaporation tank discharge. It appears that the basin was connected to the sanitary sewer at this time.

Storm water runoff is either controlled by a storm drain system, or is directed off site by ditches or surface grading. The storm drainage system is comprised of two catch basins located in the parking area and between two of the buildings in the middle of the parcel. The drainage system discharges to the boatway on the waterway side of the settling / evaporation tank. In 1990, samples taken from the storm drain outlet detected oil and grease, copper, and zinc.

A ditch is located along the western property boundary.

We have attributed modest releases of PAHs (oil and grease), metals (particularly copper from spent sandblasting grit), phthalates (may have been used in resins, but no specific evidence), VOCs (solvents), and TBT (from power washing boats).

Joseph Simon & Sons, a second round cash-out party, has owned parcel 17 for 24 years, operating on it for 4 of those years. Its wholly-owned subsidiary, Rail and Locomotive Equipment Co., operated on the parcel for 4 years. Joseph Simon & Sons purchased the property on June 10, 1975. Beginning in about 1980, and continuing until about August 1984, Simon & Sons operated Rail & Locomotive Equipment Company⁴¹ (RLEC) at the site. Beginning in 1988, Cascade Timber leased a portion of this parcel for log storage operations.

Potential releases of metals are also associated with previous locomotive storage and dismantling activities on upland portions of the site and, to a lesser extent, log sorting operations. Soils in a pile along the east property line were found to contain metals above the SQO. Although not adjacent to the shoreline, the Department of Ecology has determined that the pile was a threat to the Hylebos Waterway because of the potential for erosion.

Potential releases of petroleum-related compounds are associated with Joseph Simon & Sons' practice of pumping out residual diesel and waste fuel prior to dismantling of locomotives⁴². Both surface and subsurface soils in the northwest portion of the parcel have been impacted by petroleum product releases, primarily diesel and oil. Some of the samples contained gasoline. Organic compounds were not detected above state regulatory levels. Although the Department of Ecology determined that the petroleum-contaminated soils in the western portion of the property did not impact the Hylebos through groundwater discharged to the ditch, it appears that some of the contamination extends to the shoreline near the head of the

⁴¹ Rail and Locomotive Equipment was a 100% owned subsidiary of Joseph Simon and Sons. Douthwaite, 7/14/95.

⁴² Harris Petroleum Company (not an Exhibit D party) used two 12,500-gallon above ground storage tanks in the 1950s and 1960s, another source of PAH compounds.

small bay. Therefore, we have assumed some potential for releases from the shoreline area and we have assumed that the surface water runoff that flows to the Hylebos may have been impacted by the petroleum-contaminated soils.

Surface soils from upland areas on the west side of the site contained bis(2-ethylhexyl)phthalate (BEP) exceeding the SQO. We have assumed some potential for release via storm water runoff. We note that BEP has been detected in intertidal sediments in the embayment area surrounding the open channel ditch along the property. The source of the BEP contamination is unknown. The chemical is used as a plasticizer for polyvinyl chloride and other polymers, as a replacement for PCBs in dielectric fluids for electrical capacitors, and may also be a by-product of plants and animals. It is widely distributed in the environment as a result of its use as a plasticizer.

Department of Ecology sampling of surface water runoff in 1991 indicated elevated levels of metals and PCBs. PCBs have been detected in shoreline area soils. One surface sample contained PCBs at 300 ppb while SQO exceedances were found in two test pits on the east and west sides of the bay at 431 ppb and 1110 ppb. Based on a review of records of all locomotives received, Joseph Simon and Sons believes that there were no PCBs in any of the capacitors.

Joseph Simon and Sons, in cooperation with the Department of Ecology, completed investigations at the site and developed a plan for remediation. An Agreed Order for removal of approximately 7,900 cubic yards of soils contaminated with arsenic, copper, lead, mercury, zinc, petroleum hydrocarbons and PCBs has been issued for comment.

We have attributed modest releases of metals and PAHs from the Rail & Locomotive Operations. The source of PCBs at this site is not definitively known. The evidence in the record would seem to discount Rail & Locomotive as a source of PCBs, but the possibility does exist that some of the electrical equipment in cars and locomotives handled by Rail contained PCBs. In addition, during the time of Joseph Simon & Sons ownership of the parcel, PCBs apparently have had the potential to migrate from the site. Thus, we have attributed the possibility of PCB contribution to Joseph Simon & Sons.

Kaiser Aluminum has owned and operated an aluminum reduction plant on parcel 30 for 45 years (assuming about 6 years during which the plant was not operational). This parcel does not have waterfront access but wastewater from the parcel has been discharged to the Hylebos via a ditch from the property. Permanente Metals ("Permanente"), a corporate predecessor of Kaiser, took possession of the aluminum reduction plant and property in January 1947.

Kaiser also is associated with parcels 29 and 32. With the exception of landfilling of inert materials, such as brick and concrete, Kaiser did not conduct operations on parcel 29. There is some indication that spent potlining was stored on this site. However, regardless of whether potlining was stored here, at the time it was stored, the waterway had not been extended to its present location. It is unlikely that runoff from any potlining area would have resulted in the current sediment contamination.

Aluminum production utilized an electrolytic cell containing a fluorinated compound of sodium and aluminum cryolite. The cell consists of a steel shell lined with inert, insulating materials and an electrically conductive bottom made of carbon paste. Anode and cathode pastes are made on-site at the Paste Plant by mixing 25% coal tar pitch with 75% petroleum coke. Potlining consists of a steel shell, thermal insulation, carbon lining (calcined anthracite coal and coal tar pitch), steel collector bars, and silicon carbide brick walls. When the molten bath and metal has destroyed the integrity of the potlining, the pot is taken out of service and the lining is removed and replaced. The material removed is referred to as "spent potlining." When the current flows through the cell, alumina is split into metallic aluminum, which spreads over the cell bottom, and oxygen, which evolves at the anode. Fluoride gasses, particulate matter, and pitch fumes (PAHs) also evolve from the cell and are captured in a scrubber.

Prior to restarting of the plant in 1947, wet scrubbers were installed to control fumes from the potrooms. The scrubbers originally discharged to a slough tributary to the Hylebos. In 1951, Kaiser installed settling ponds that were directed to Hylebos Creek via a ditch. Kaiser began lime treatment of the scrubber effluent in addition to settling in 1957. Scrubber effluent was handled in this manner from 1957 until the plant closed in 1958 and when the plant reopened in 1964 until 1974. In 1974, the operation began using dry scrubbers and the wet scrubber discharge to the ponds ceased.

While the facility was operated as Plancor 245, pot skimmings were reprocessed to retrieve valuable cryolite and recycled back into the process. Failed potliners were generally put in the kiln for disposal. Kaiser indicates that spent potlining, containing approximately 33% carbon, was disposed on site between the time the facility opened⁴³ until it was shut down in 1958. Between 1958 and 1964, the disposed potlining was removed to off-site facilities. Potlining continued to be taken off site after the facility reopened in 1964 and until 1978.

Cooling water from various⁴⁴ sources also has been directed to the settling ponds.

Oil storage facilities located on site included a 10,000-gallon fuel oil UST, a 275-gallon and a 500-gallon diesel ASTs, a 15,000-gallon water-oil cooling agent, and about 15 55-gallon drums of lube oil.

Stormwater runoff from the potlining facility was high in cyanide. It likely soaked into the ground or flowed into storm drains until 1958, when the storm sewers were blocked to prevent migration of cyanide. Blocking the sewers caused a "lake" to form on the property. In 1958, Kaiser constructed a batch treatment plant for treating spent potlining runoff with sodium hypochlorite. From 1966 to 1984, treated runoff either was directed to the settling ponds and then the Hylebos via the "Kaiser" ditch or was directed to the City storm sewer in Taylor Way and then to the Hylebos. From October 1984 to 1986, the wastewater was directed to the ponds. In 1986, Kaiser began dry removal and storage of spent potlining and the discharge ceased.

⁴³ The spent potlining management facility closure report (c. 1986) states that SPL had been stored outside since 1943. See KAI391674.

⁴⁴ Cooling water sources have included the power substation, the rectifier, the casting facility, and the rod mill.

In 1987, Kaiser indicated that PAHs, cyanide, nickel, and PCBs were pollutants known to be present in its manufacturing activity or generated as a by-product. Trichloroethene was suspected to be present.

Pathways

Nearly all discharges from the plant, including most of the stormwater discharges, have been routed through settling lagoons, and later, settling ponds, and then to the "Kaiser" ditch.

Scrubber water usage increased from 1,800 gpm to 3,400 gpm when Potline IV was constructed in 1968.

Until the early 1960s when the waterway was extended, the "Kaiser" ditch discharged to Hylebos Creek. The creek entered the waterway near the lower turning basin. In 1960, the turning basin was dredged during the extension of the Waterway.

A 1969 diagram depicts drainage from the lab area flowing to the city storm sewer in Taylor Way. The sewer appears to flow in the direction of the "Kaiser" ditch and is assumed to ultimately discharge to the Hylebos via the ditch. This discharge appears to correspond to the present Outfall 003.

Since approximately 1969, drainage from around the Rod Mill facility on the southeast corner of the property has flowed south and east and eventually to the Hylebos Creek. This discharge appears to correspond to the present Outfall 004.

Investigation Costs Impact

PAHs: PAHs are present in several segments of the aluminum plant's operations. Anode and cathode pastes are made on-site at the Paste Plant by mixing 25% coal tar pitch with 75% petroleum coke. Potlining consists of a steel shell, thermal insulation, carbon lining (calcined anthracite coal and coal tar pitch), steel collector bars, and silicon carbide brick walls. Gasses, particulate matter, and pitch fumes (PAHs) evolve from the electrolytic cells and, between 1947 and 1974, were captured in the scrubber.

Scrubber Sludge

The scrubbers originally discharged to a slough tributary to the Hylebos. In 1951, Kaiser installed settling ponds that were directed to Hylebos Creek via a ditch. Kaiser began lime treatment of the scrubber effluent in addition to settling in 1957. Scrubber effluent was handled in this manner from 1957 until the plant closed in 1958 and when the plant reopened in 1964 until 1974. Scrubber water usage increased from 1,800 gpm to 3,400 gpm when Potline IV was constructed in 1968. In 1974, the operation began using dry scrubbers and the wet scrubber discharge to the ponds ceased.

A 1957 letter from Kaiser to the PCC states that the flow out of the settling pond was about 600-700 gpm. At least 90% of suspended solids and at least 70% of tars and oils were removed in the pond. This implies that the pond discharge contained some tars and oils.

Kaiser dredged the settling lagoons in 1969 and 1971 and possibly around 1955. Dredge spoils were disposed adjacent to the lagoons. During the dredging episodes, some sludge may have been released to the ditch and subsequently to the Waterway.

In the early 1990s, sediments in the "Kaiser" ditch were found to have PAH concentrations between 13.5 ppm and 205.9 ppm. These contaminated sediments were to be removed as part of the Consent Decree.

Documents vary in their indications of the amount of PAHs contained in scrubber sludge. A concentration of less than one percent PAH compounds in the sludge is referenced in the 1990 consent decree for the sludge cleanup. However, this concentration refers only to the four- to six-ring compounds. Other estimates of PAH concentrations range from one to five percent.

Between 1950 and 1974, as much as 82,000 cubic yards of solids were generated and were still on site in 1989. In 1984, the storm drainage system was modified to better isolate the sludge area and sludges were consolidated to reduce the size of the disposal area. In the 1980's, the sludge was located in three areas in a total area of 475,000 square feet (11 acres).

Spent Potlining

Kaiser indicates that spent potlining, containing approximately 33% carbon, was disposed on site between the time the facility opened⁴⁵ until it was shut down in 1958. Between 1958 and 1964, the disposed potlining was removed to off-site facilities. Potlining continued to be taken off site after the facility reopened in 1964 and until 1978. Stormwater runoff from the potlining facility was high in cyanide. It likely soaked into the ground or flowed into storm drains until 1958, when the storm sewers were blocked to prevent migration of cyanide. In 1958, Kaiser constructed a batch treatment plant for treating spent potlining runoff with sodium hypochlorite. From 1966 to 1984, treated runoff either was directed to the settling ponds and then the Hylebos via the "Kaiser" ditch or was directed to the City storm sewer in Taylor Way and then to the Hylebos. From October 1984 to 1986, the wastewater was directed to the ponds. In 1986, Kaiser began dry removal and storage of spent potlining and the discharge ceased.

The area in back of the lab building was used for temporary storage of spent potlining before 1958. Some buried SPL may have sunk into the ground and been covered with fill. A 1969 diagram depicts drainage from the lab area flowing to the city storm sewer in

⁴⁵ The spent potlining management facility closure report (c. 1986) states that SPL had been stored outside since 1943. See KAI391674.

Taylor Way. The sewer appears to flow in the direction of the "Kaiser" ditch and is assumed to ultimately discharge to the Hylebos via the ditch. This discharge appears to correspond to the present Outfall 003.

Miscellaneous

Circa 1956, Kaiser was using waste oils and sludges for dust and vegetation control on roads and in transformer yards. Two diesel and one gasoline UST were installed when the plant was built in 1942. One of the diesel tanks was removed in 1978 and the remaining tanks were removed in 1986. Oil storage facilities currently located on site include a 10,000-gallon fuel oil UST, a 275-gallon and a 500-gallon diesel ASTs, a 15,000-gallon water-oil cooling agent, and about 15 55-gallon drums of lube oil.

Other sources of PAH-contamination include pitch spills, waste paste, air control media, and duct dust. In the past, most PAH wastes were stored with spent potlining. Prior to the 1980s when the HEAF filters were installed, a wet scrubber was used to reduce emissions from the paste plant. Water from the wet scrubber was discharged to an oil / water separator and then discharged to the storm drain, which flowed to the ponds.

Coolant consisting of 15% water-soluble oil and water is used in the rod mill. From 1969 to 1972, spent coolant was discharged to the soil in back of the rod mill. Since approximately 1969, drainage from around the Rod Mill has flowed south and east and eventually to the Hylebos Creek. This discharge appears to correspond to the present Outfall 004. In October 1969, PCC personnel traced a "silvery looking oil" from a drainage ditch at the eastern end of Taylor Way to a "drainage ditch from the most Southeast building of Kaiser Aluminum." Apparently, the paved area at the head of the ditch had recently been washed down. Based on the description, it appears the building may have been the rod mill.

In 1990, Outfall 001 was sandbagged to prevent wastewater from fighting a coal tar pitch railcar fire from reaching the Hylebos.

PAHs may have been discharged to the Hylebos via surface water runoff or process water (scrubber water) discharge to the waterway. The shallow groundwater aquifer at the site flows towards the Hylebos and the Blair. A 1987 groundwater study indicated there was no evidence that PAHs were moving in groundwater.

PCBs: Some electrical transformers currently located on site contain PCBs. The Ederer's Crane, a hydraulic crane used on Potline 3, contained 100% PCB fluid. With the exception of a spill in 1986, only incidental leaks have occurred and have been contained and prevented from migrating off site. In 1988, Kaiser disposed of 29 tons of PCB-contaminated soil debris.

In 1986, about 2900 gallons of PCB-contaminated transformer oil was released to the soil in the transformer yard. Much of the oil was recovered by basement sumps and an oil / water separator. There was no evidence that PCBs from the spill entered the Hylebos.

We have attributed to Kaiser appreciable releases of elevated concentrations of PAHs. We have assumed, based on sampling results at Kaiser's Outfall 001, that it is a possible source of PCBs, phenols, and metals.

Kaiser's RM and SQO scores takes into account the fact that significant PAH releases did not occur subsequent to the installation of dry scrubbers in 1974 and in light of the fact that releases of PCBs, phenols and metals are not believed to be significant.

Kalama Chemical, a second round cash-out party, owned and operated Sound Refining, a petroleum refinery, on parcels 58 and 59 for 5 years.

Since 1967, the wastewater treatment system has discharged to the Hylebos Waterway. Contaminants of concern associated with activities on the parcel that could have potentially been released to the Hylebos Waterway include metals, PAHs, phenols, and organics. The potential release of metals may be associated with the reported use of Asarco slag as fill along the northern length of the marine dock in late-1975/early-1976. Metals have also been detected in the process effluent.

Kalama is one of three owner/operators of this facility. The impacts of the operations from these parties can be distinguished based on their respective production volumes, discharge volumes and the loadings of oil and grease discharged pursuant to permit limitations. Based on the evidence in the record, as supplemented during oral arguments, it appears that the following can be concluded:

Under Kewanee Chemical, the oil and grease discharge limit was 50 mg/l and concentrations in discharges are assumed to be 20-30 mg/l on volume of about 120,000 to 130,000 gallons per day. During Kalama's ownership, an improved wastewater treatment plant was installed, the permit limitation was reduced to 15 mg/l, and concentrations averaged 10-12 mg/l on volume of about 70,000 gallons per day. Under Crysen, an air floatation system was added in 1991 to allow the plant to meet a 5 mg/l oil and grease limitation on average discharge volumes of about 50,000-60,000 gallons per day. Crysen operated the facility an average of 140 days a year compared to about 200 days for Kalama.

These contaminants have also been released as a result of spills from operations. During the early 1970s, the Department of Ecology noted a constant oil spill from the bank along the property. The spill was attributed to a leak in a production line.

Organic contaminants associated with petroleum compounds have been detected in site surface soils, in the crude oil and gasoline storage areas, and in groundwater. These contaminants would migrate to the Hylebos via surface water and groundwater flow.

PAHs and phenols have also been detected in the process effluent. The discharge in 1995 contained approximately 10 or 11 parts per million phenol. Pentachlorophenol, which was historically used in the process for slime and algac control, has been detected at relatively large concentrations.

Production increased during Kalama's ownership. Between 1976 and 1979, Sound refined approximately 6,500 barrels of oil per day. In 1978 and 1979 the operations were expanded to refine a heavier oil, and production was increased to approximately 20,000 barrels a day.

In light of its process discharge, we have attributed to the three owner/operators of this refining plant appreciable releases of PAHs and metals.⁴⁶ Kalama and Crysen have been cited for various enforcement violations and permit exceedances. I have not found sufficient distinctions in the nature of these enforcement violations to materially distinguish these two parties. I have distinguished them on the basis of their respective years of operation, the volume of discharges and oil and grease concentrations in their discharges.

Kewanee Chemical owned and operated Sound Refining on parcels 58 and 59 for 9 years. It is not an Exhibit D party. However, arguments have been raised that Kalama should be attributed Kewanee's share. The allocation agreement directs me not to consider contractual arrangements in allocating costs. Thus, I have included a share for Kewanee Chemical as a separate entity.

Please see discussion, above, under Kalama Chemical.

Linden Trucking operated under a lease from the Port of Tacoma on parcel 4 for an undetermined number of years. We have no further information on these operations and do not have a basis to attribute a share to this entity at this time.

Lone Star Northwest, a first round cash-out party, has owned parcel 32 for 12 years since December 1987 and operated a concrete batch plant. In 1993, Lone Star leased a portion of the parcel to Tucci & Sons for operation of an asphalt batch plant.

Potential releases of contaminants are associated with the diesel fueling operations and the use of underground fuel storage tanks. In approximately 1970, two underground storage tanks were installed. In 1990, approximately 350 cubic yards of petroleum-contaminated soil were removed in conjunction with the removal of the two tanks. In 1987, trace levels of benzene and phenols were detected in groundwater, and metals were detected slightly in excess of water quality criteria. The trace levels of benzene were detected near the underground fuel storage tanks. All four soil samples contained low levels of arsenic, copper, and zinc typical for soils.

Historically, some site runoff may have ultimately been discharged to the Hylebos via the "Kaiser" ditch. Calculations indicate that the groundwater flows towards the Hylebos Waterway. In 1989, surface water drained primarily towards the on-site settling ponds (which ultimately discharge to the sanitary sewer) and the Hylebos. In July 1993, all stormwater and wastewater from truck rinsing and equipment cleaning was being captured in ponds and used in Lone Star products. Overflow from the ponds and holding tanks would drain to the sanitary sewer.

⁴⁶ We also have attributed to Asarco, minor releases of metals associated with its slag placed along the bulkhead.

Historically, a portion, approximately 20-25%, of stormwater flowed to the Hylebos. However, there is no specific evidence that contaminated stormwater reached the Hylebos. Although all but a small portion of the site is currently paved, and stormwater would be absorbed by the ground, the potential release of contaminants via the soil has been incorporated in the potential release of contaminants via the groundwater. In the 1980's, storm drainage, including gravel wash water, was being discharged to the "Kaiser" ditch via the Weyerhaeuser log yard storm drain system. In the early 1990's, Lone Star began neutralizing its wastewater. Stormwater was only being discharged if more water accumulated in the settling ponds than could be contained in the ponds and holding tanks.

Organic contaminants, phenols, and metals have been detected in the site's groundwater, which flows towards the Hylebos Waterway. Soils contaminated by metals have been detected at levels within groundwater ranges. It appears that contaminated soil and groundwater, due to releases or spills associated with the underground storage tanks and possibly due to tank spillage, may have affected the Hylebos Waterway. We have assumed modest releases of organics, metals, and phenols, via groundwater. Because organics and phenols have been detected at trace levels, we have assumed only a minor SQO impact for these chemicals from this parcel during the past nine years. Metals were detected above regulatory limits.

Louisiana Pacific has owned and operated a log sort yard and sawmill on parcel 33 for the past 25 years, since 1974. From 1986 to 1987, Louisiana Pacific leased parcel 34 as a log storage yard. Louisiana Pacific leased parcel 36 for a few months in 1986 for use as a log sort yard.

Logs are delivered via truck or water. They are unloaded and placed into decks from which they are moved to the sawmill with a front-end loader or similar equipment. First, the logs are debarked. Bark waste is ground into hogged fuel and sold. Saws are used to cut the logs into lumber. Waste is chipped and transferred to bins via pneumatic equipment. The lumber is dried in a natural gas-fired⁴⁷ kiln and then stored prior to shipment. Because the lumber is kiln-dried, a chemical sap-stain control process is not necessary.

Louisiana Pacific believes about 2400 tons of Asarco slag was deposited on the parcel. The log sort yard was maintained by periodically scraping off the spongy top layer and reballasting. Metals contamination on the parcel is attributed to Asarco.

In 1987, a site investigation found elevated levels of arsenic, copper, lead, and zinc in soils at several locations on the parcel. These metals also were detected at elevated levels in stormwater runoff from the parcel.

In the late 1970's, there were several incidents in which oils were released to the storm drain system on the parcel and subsequently discharged to the waterway. Diesel fuel and gasoline were stored underground. The equipment wash area, a probable source of oils, silt and mud, cleaning detergents, and chemicals, drained to the storm sewer system. Since 1993, wastewater generated from the steam cleaning of equipment has been discharged to an oil/water separator.

⁴⁷ Diesel fuel is used as a back up fuel.

Metals were found to migrate in the shallow groundwater at the site. Two groundwater monitoring wells were established to determine if the confined or intermediate aquifer was a significant pathway for metals migration into the Hylebos. Concentrations of metals in both wells were very low, indicating that groundwater transport is not a significant pathway. Except for at high tide, groundwater in the upper, unconfined aquifer generally flows north to the Hylebos Waterway and Hylebos Creek.

Surface runoff from the yard is ditched to Hylebos Creek. Catch basins are linked to four pipes that discharge to the Hylebos Waterway. In 1993/1994, the site was capped and a storm water collection and treatment system consisting of an oil/water separator and sedimentation system were required.

Non-contact cooling water from the sawmill air compressors is piped to the Hylebos Waterway. Boiler blowdown containing boiler chemicals has been directed to the storm drain system. It is currently discharged to the city sewer system.

Contaminants associated with parcel 33 include wood waste, PAHs (from oils and grease), and metals (including arsenic from slag). It is possible that some of the hydraulic oils used on the parcel contained PCBs. However, there is no evidence to support such an assumption. In light of evidence of oil-related releases from parcel 33, we have attributed a modest release of PAHs and phenols (from woodwaste) to this activity. Assuming that runoff from parcel 34 discharged to Hylebos Creek via the Fife Ditch, we have attributed a minimal release of PAHs and woodwaste from this parcel during Louisiana Pacific's operations. We have not attributed any investigation costs to Louisiana Pacific for its activities on parcel 36.

Manke Lumber a second round cash-out party, used parcel 40 from 1974-1976 for wood chip stockpiling and heavy equipment storage. The wood used for chipping was untreated. Manke Lumber has owned and operated a sawmill on parcel 42 for 34 years. Logs were received and cut into dimensional lumber. When operations began in 1965, logs were received by truck and by water. Facilities include a spray booth, dip tank and machine shop. Parcels 42a, 42b, and 44 are adjacent to each other and are situated across Marine View Drive from Parcel 42. Manke used these parcels for a variety of operations. Manke Lumber was a tenant on parcel 67 during 1977-1978. Manke's sole activity on parcel 67 during 1977-1978 consisted of the storage of log rafts in the intertidal area. No vehicular transport of logs was involved

From 1971 until July 1988, Manke used a sodium pentachlorophenol (PCP) solution for sapstain control on lumber. Until mid-1982, the solution was sprayed on the lumber as it exited the sawmill's planer. In 1982, a dip tank replaced the enclosed spray booth. About 5,000 gallons of solution were kept in the tank. The lumber was dipped and held on a forklift over the tank for about 15 minutes until the dripping stopped. There was no containment around the tank or haul out area. A storm water drain was adjacent to the tank, and spillage was present around the drain and tank. Runoff from the treating area and / or runoff from the bundle-painting area was entering the storm drain. In 1983, Manke installed a drip rack to contain all drippage and, in 1985, a roof was added to the tank. As of April 1986, the dip tank had secondary containment with a sump to return drippage to the tank. Treated lumber was being stored out doors in a paved

area with numerous storm drains. In 1987, cracks were noted in the secondary containment. In March 1988, Manke was required to remove all visually contaminated soil around the dip tank and was fined \$25,000. In July 1988, Manke switched from sodium PCP to "NP-1." In 1989, a new, enclosed spray booth replaced the dip tank. In November 1989, sampling revealed that soils in the dip tank area were contaminated with PCP above action levels. Water-based end paint is applied with a spray gun under the roof at the bander.

Since the late 1980's, the larger hydraulic equipment has been placed in covered areas and sit in drip pans. In the early years, the systems were not placed in drip pans.

At some time, a PCB-containing capacitor was replaced. Three transformers, maintained by the City of Tacoma are located on a concrete pad on site. They were upgraded in the 1970's. There is no evidence in the record of any leakage in the transformer area.

In 1991, approximately 200 gallons of diesel oil were released when a tank ruptured. Other spills to the ground were noted.

Prior to the widening of Marine View Drive, a drainage ditch ran continuously along both sides of the road. Surface runoff from areas adjacent to the ditch would flow into the ditch, and presumably flow to the Hylebos. Since 1990, the City's storm drain outfall for Marine View Drive has run beneath Manke's property to the waterfront.

There are four outfalls from parcel 42 (001 through 004). Outfall 001 is located on the southeastern property boundary with Jones-Goodell (Parcel 41). Surface runoff from both Manke and Jones-Goodell flows through this outfall.

Storm drainage from the machine shop and lumber storage areas is discharged through Outfall 002. This outfall was probably installed in 1987. Outfall 003 discharges from the sawmill / log yard area and drain system. It was the main outfall for the original sawmill. Samples taken from the "main outfall"⁴⁸ in 1991 revealed low (i.e., below water quality standards) levels of phenols and elevated levels of oil and grease.

Sheet flow runoff from the northwestern part of the site is discharged through Outfall 004, located on the western edge of the property bordering Tacoma Boat. Estimates from 1989 indicate that about 80,000 gpd of stormwater discharged through this outfall during a storm event.

Potential contaminants associated with parcel 40 include wood waste (woodchip piles) and PAHs (oil from bulldozers used to move woodchips). Potential contaminants associated with Manke's operations on parcel 42 include phenols (PCP in dip tank and spray booth), organics (end paint), PAHs (diesel fuel, hydraulic oil), and PCBs (electrical equipment, hydraulic equipment).

⁴⁸ Outfall 003 is assumed to be the main outfall.

Manke's office and pellet plant are located on Parcels 42a, 42b, and 44. The pellet plant uses sawdust to manufacture pellets to be burned in wood stoves. A parts washer and 550-gallon AST with hydraulic oil are located at the pellet plant.

A truck shop is also located on these parcels. It began in 1976 as a small repair shop for oiling and greasing vehicles. A steam cleaning operation, with a wash slab and oil / water separator was added in the late 1970's or early 1980's. Until 1988, when they were connected to the sanitary sewer, the slab and oil/water separator drained into the road drainage ditch. Two USTs (gasoline and diesel) were cleaned and filled with inert material in 1986. A third UST (diesel) was deactivated in 1990. Currently, the shop facilities include two 2000-gallon ASTs (hydraulic oil and motor oil), a 550-gallon AST for transmission fluid, a 275-gallon grease tank, four parts washers, a waste oil tank, and a used antifreeze drum.

A 10,000-gallon diesel UST⁴⁹ was removed in 1991. The tank had leaked resulting in hydrocarbon contamination in the surrounding soil and groundwater.

In 1976, Manke was steam cleaning next to a ditch, resulting in oil pollution to surface waters. WDOE recommended the installation of a wash pad with sump followed by an oil / water separator. Currently, the oil / water separator is pumped out about twice a year and generates about eight to ten barrels of sludge per year.

A tallow storage facility is located on Parcel 42b. It has been leased to Northwest Terminals since 1988. Tallow is trucked in or brought by rail. It is stored in about 36 aboveground tanks. The tallow is heated so that it can be pumped via pipeline to ships berthing at the Manke dock on Parcel 42. About four to five ships per month have been loaded since 1988.

Drainage from these parcels 42a, 42b, and 44 flows to the drainage ditch along Marine View Drive. A stormwater runoff pond at the pellet mill is used to settle out debris. It also discharges to the ditch. Currently, the ditch flows to the Morningside Drain, which discharges to the Hylebos near Parcel 48. In early 1987, the oil / water separator was discharging to the Marine View Drive ditch. In 1988, it was connected to the sanitary sewer. Several inspection reports from the late 1970's and early 1980's indicate oil contamination in the ditch.

Potential contaminants from Manke's operations on parcels 42a, 42b, and 44, include PAHs (from steam cleaning operation and underground storage tanks). Runoff and discharge from the steam cleaning operation (until 1988 when the oil / water separator was connected to the sanitary sewer) was transported via a ditch along Marine View Drive to the Hylebos Waterway.

We have attributed an appreciable release of PAHs, and phenols from the combined Manke operations on parcels 42, 42a, 42b, and 44. We have not attributed any investigation cost share to Manke with respect to parcels 40 and 67.

⁴⁹ This UST is assumed to be the third UST described earlier.

Manke's RM score takes into account EPA's actions concerning wood waste, and the magnitude of wood waste releases. Balanced against this is the fact that Manke, as a member of the Wood Debris Group, has funded wood waste investigations in the Head of the Waterway.

May, Annon and Smith, Wendell owned and operated **PRSI (PRSI 1)** on parcel 27 from 1977 to September 1987.

During the operations of PRSI 1, the parcel was not paved and releases on site were not as well contained. The tank area was not contained during the first five years of operations. Thus, surface discharges via the ditch to the Hylebos were more likely from this parcel during that time. We have assumed that contribution from PRSI 1 was significantly higher than the share of the entity that took over subsequent operations on the parcel (PRSI 2).

Potential releases of contaminants are associated with the treatment of wastewater and oil. Contaminants associated with PRSI's reclamation facility include metals, organics, PAHs, and possibly PCBs. An investigation in 1985 revealed that the entire site contained high levels of heavy metals in the ditch sediments, surface water, soils, and groundwater. In addition, PAHs and PCBs were detected in surface soils and ditch sediments at levels above sediment quality objectives.

The facility had been in operation for four years before a dike was constructed around the tanks. Historically (prior to 1988), surface water runoff flowed to either of two ditches located on the north and east boundaries of the property which ultimately drained to the Hylebos. In 1988 the site was paved and most of the surface water runoff was directed to sumps which drain to the sanitary sewer. Most of the unpaved areas of the site are along the north and east property lines. These areas are sloped toward paved areas and away from the drainage ditches, which flow to the Hylebos. A small area along the southwest edge of the site was also unpaved. Some storm water on the unpaved area infiltrated into the soil/fill and groundwater. Any contaminants released by previous operators of the site may have reached the Hylebos.

At this time it is unclear whether the groundwater flows towards the Hylebos, and thus whether contaminants detected in the groundwater would reach the Hylebos.

Process wastewater now is discharged to the sanitary sewer. During 1984, the company processed 1,261,000 gallons of waste oil, and between 1,000 and 6,000 gallons of process wastewater was generated daily.

Various contaminants are associated with this operation:

Metals: Solids generated consisted of oily sludge, metal-based oil additives (calcium, magnesium, barium, zinc), lead, and metal filings. Ecology's consultant concluded that the entire site contained high levels of heavy metals in the surface soil, groundwater, and surface water. In 1990, Ecology collected and analyzed soils samples for metals, PCBs, and pesticides. A sample collected from the ditch along the eastern property line contained levels of arsenic exceeding the sediment quality objective. During a 1990 audit, arsenic and mercury were detected above regulatory action levels. Subsequent

investigations revealed that the groundwater was also contaminated by arsenic and cadmium.

VOCs: Analysis of the wastewater treatment sludge revealed detectable levels of organic contaminants. Organic soil contamination was distributed across most of the site. In 1986 Ecology's consultant found that surface soils contained elevated levels of organics. In 1991 PRSI's consultant completed an environmental audit which included sampling and analysis of soil and groundwater. Of the highest levels of contaminants reported in the upper groundwater table, xylene was the only contaminant for which the SQO was exceeded.

PAHs: The waste oil often contained combustion products, which include PAHs. Sediment samples were found to contain PAHs. The organic contaminants identified in the soil were indicative of fuel and lubricating oils, oil and/or combustion by-products, and plasticizers, among others. During a 1990 audit, PAHs were detected above regulatory action levels. Subsequent investigations revealed that the groundwater was also contaminated by TPH.

PCBs: The organic contaminants identified in the soil were indicative of transformer and capacitor fluids, among others. In 1986 Ecology's consultant found that surface soils contained elevated levels of PCBs. Aroclor 1260 was distributed across the site.

The site is not very large. However, given the likely discharge of process wastewater, we have attributed to this parcel a modest release of the above contaminants at elevated levels.

McChord Air Force Base is an Exhibit D party. We have not identified activities associated with this entity that would merit an investigation cost share. See discussion, below, under U.S. Air Force.

Milgard Manufacturing owned and operated a glass manufacturing facility on parcel 69 for the past 21 years.

Potential contaminants associated with Parcel 69 include metals (lead discharge from Spandrell wastewater), PAHs (from oil contained in cooling water discharged to storm drains), and VOCs (from gasoline spill, glues in wash water).

There are two ditches along the perimeter of Parcel 69. One is located on the northern boundary; the other is on the western boundary. The ditches join at the northwestern corner of the property. A single channel flows in a northerly direction toward the Fife Ditch, which eventually discharges to the Hylebos Creek. The Hylebos Creek ultimately discharges to the Waterway.

Waste streams directed to various storm drains on the parcel include glass washer wastewater, non-contact cooling water from one of the air compressors, surface drainage between the buildings, and roof drains. A floor scrubber that uses water as a rinsing agent is drained and serviced outdoors; material eventually reaches the storm drains.

Contaminants attributed to this operation include:

PAHs: Cooling water, which may contain small amounts of oil, for the glass edgers is also routed to the storm drains on the south side of the plant. In 1985, approximately 10 to 20 gallons of gasoline were released to the storm drains when the fire department washed a gasoline spill off the parking lot. The storm drains are tributary to an open ditch tributary to the Hylebos. A 10,000-gallon fuel (presumably gasoline) UST was removed in 1988. The tank was in good shape and there was no fuel odor from the excavation.

Metals (Lead): The Spandrell process for coating glass took place in a spray booth for approximately 8 months prior to 1986. The process generated waste sludge and lead floccing supernatant. The wastewater was treated until its total lead concentration was below 5.0 mg/L. When the appropriate lead concentration was reached, the wastewater was discharged outside onto the soil outside the building from whence it flowed to north ditch. There were four to six such discharges over a six to eight month period (estimated worst case as 1,000 gallons per month). It is not known how the sludge was treated and/or disposed. After about eight months of spray application, the Spandrell process changed to a roller application. Roller application generates waste mineral spirits instead of sludge and supernatant.

VOCs: The Lenhardt line uses a chemical reaction to produce thermal pane panels. It began operating in 1986. Wastes were either base or solvent, often methylene chloride, from purging the system. Wastes were drummed and disposed off site. Glass washer wastewater containing detergent is discharged to a storm drain at the plant. Some of the storm drains ultimately discharge to a ditch on the western side of the property. In addition to detergents, the waste wash water may contain silica dust, aluminum fragments, vinyl fragments, and glues.

Given the fact that releases did not occur throughout the entire operating period, we have attributed to this operation minimal releases of the above contaminants.

Mintercreek Development, a first round cash-out party, has owned parcels 60 and 61 since 1983, and has leased the property to various companies. Pacific Marine Repair leased the property for approximately seven and one-half years, from 1988 through May 1995.

Based on available documentation, it appears that no sampling of any media on the property has been conducted. Therefore, we can not determine whether any potential contaminants of concern may have been released to the Hylebos. It is possible that contaminants of concern may have been released to the Hylebos due to the oil soaked gravel and metal shavings identified on the property in 1990. However, there are no maps in the record showing where the storage yard or fabrication shop are located, and whether surface water runoff from these areas may have entered the Hylebos. We have assumed only minimal releases of PAHs and metals at minimal concentration levels.

Modutech Marine, a second round cash-out party, has operated a boat repair and pressure washing operation on parcel 52 for the past 15 years.

For approximately ten years, from 1984 to 1993, Modutech discharged approximately 1,000 gallons per year of wastewater generated from pressure washing the bottom of boats to the Hylebos Waterway. This wastewater contained copper from bottom paint.

Releases of metals also occurred via stormwater runoff that carried spent sandblast grit from the drainage swale and yard to the Hylebos Waterway. At one time spent grit was spread throughout the property. The Department of Ecology has observed the grit in soils in the berm along the water, in the tidal area, and in the swale. A sample taken outside of the sandblast shed, which consisted mainly of spent grit, contained 2,800 ppm of copper.

PCB releases associated with this parcel appear to originate from the auto fluff that was found on the adjacent Parcel 51. Concentrations of PCBs and metals from the auto fluff and Hylebos sediments in exceedance of SQOs have been detected on the adjacent parcel. A sediment sample collected closest to the Modutech property line detected PCBs and lead in exceedance of SQOs.

PAHs, phenols, phthalates, and dibenzofuran were detected in a sample from the marine railway. The sources of these contaminants are not well understood. Motor oils and diesel fuels used on the site may be a source of PAHs. We have attributed minimal releases of these contaminants and metals to the operation. Metals are assumed to be at elevated levels. We have not attributed PCB contamination to Modutech.

Murray Pacific co-owned and operated log yards at parcels 22, 22a, and 22b (Log Yard # 1) for 22 years, parcel 24 for 6 years and parcel 28/70 for 11 years. Given the size of the yards on parcels 22 and 24 and their proximity to the Hylebos, we have attributed modest amounts of PAH compounds and phenols (from woodwaste) to these operations. We have attributed a minimal release from Murray Pacific's operation of a log yard on parcel 28/70.

Nars, Ragnar (Ragnar Chemical) has owned parcel 21 for the past 27 years. Metals and PAHs are associated with this parcel. In 1990 high concentrations of metals (lead and arsenic) and PAHs were detected in soils and water drainage ditches surrounding a storage warehouse building. However, it is our understanding that during this time period, drainage from these ditches ultimately discharged to the Blair Waterway. The northern portion of the site apparently discharges to the Hylebos. Accordingly, we have attributed a minimal release of PAHs and metals to this parcel.

Nordberg Auto Body operated a paint and body shop for automobiles on parcel 66 for 4 years. Wastes associated with activities at this parcel include paints, thinners, and waste oil. Inspection reports from 1984 noted waste paint and thinners on the ground and obvious signs of deliberate dumping. Car parts and rubbish have been noted scattered around the property. Storm drains collected spills and/or floor washings that discharged to the Hylebos Waterway. Waste oil was observed near and around the creek in the back of the facility.

Potential releases from this parcel include metals and organics (including petroleum-related compounds) via stormwater runoff and the creek located behind the facility. We have attributed minimal releases of metals and petroleum-related organics at somewhat elevated levels from this operation.

Nordlund Boat Company, Norman and Phyllis Nordlund, and Nordlund Properties have been treated collectively as a first round cash-out party. They owned and/or operated on parcels 42, 42a, 42b, and 44 for 12 years, parcel 7 for 40 years, parcel 18 for 21 years, and parcel 37 for 11 years, and parcel 49/50 for 20 years. Potential releases from these various activities have been extensively covered in our cash-out reports and are reflected in the investigation cost spreadsheet.

At parcel 7, we are unaware of specific evidence indicating releases of contaminants of concern associated with Nordlund Boat's activities. We have assumed minimal releases from these activities. All painting was done by a contractor in the Port Industrial Yard near the Blair Waterway, and all other components were assembled on the boats. We have assumed minimal releases from this parcel associated with Vance Lift Trucks, attributed to Norman and Phyllis Nordlund as owners. At parcel 18, there is no evidence of potential releases of contaminants of concern associated with Nordlund Boat's activities. We have assumed minimal releases from this parcel.

At parcel 37, although there is no specific evidence of releases of contaminants associated with Nordlund Boat's activities on this parcel, we have assumed that the potential for releases of metals and TBT to the Hylebos from the untreated washwater from pressure washing boats exists. In addition, we have inferred that since it was required that an oil/water separator be installed on the property, that contaminants associated with oils and grease may have been historically released to the Hylebos. According to the Nordlunds, TBT was used as a bottom paint. No bottom work or repair work was done at this facility until 1990 when the travel lift was installed. According to the Nordlunds, paint records indicate that TBT paint was not used for any repair job performed since 1990. Therefore, we have assumed minimal releases, possibly of small amounts of TBT, from this parcel. We have also assumed releases of metals via pressure washing of boats, and minimal releases of contaminants associated with oils and grease via surface water runoff. We have no sampling data for any of the three categories of contaminants of concern, and we note that there is no specific evidence that these contaminants were released to the Hylebos.

At parcel 42, potential releases of contaminants of concern have been identified, but are associated with Manke Lumber's operations. In 1991 Ecology noted that Manke's main outfall contained phenols below water quality standards, and oil and grease above Ecology's

recommended level. We are unaware of any specific evidence indicating releases of contaminants of concern associated with Nordlund Boat's activities on this parcel. We have attributed a minimal release to these activities.

We also have assumed minimal releases from the Nordlands' operation of Hylebos Boat Haven on parcel 49, 50.

Northwest Processing/Clean Care (see Poligen) is associated with parcel 15. See discussion under Poligen.

Occidental Chemical, a successor to Hooker Chemical, owned and operated on parcel 2 for 69 years. Hooker Electrochemical Company initially acquired 20.889 acres from James. M. Ashton in October 1928. Occidental began operating a chlor-alkali plant in February 1929, producing chlorine and caustic soda by the electrolysis of sodium chloride brine. The facility also includes an ammonia plant, a muriatic acid plant, and a calcium chloride plant. Other chemicals manufactured include sodium aluminate and aluminum chloride. In 1937, Hooker acquired approximately ten acres comprising the north section of parcel 2 from Todd Shipyards. In 1947, Hooker and Detrex Corporation started a joint venture to produce trichloroethylene and tetrachloroethylene cleaning solvents. The joint venture continued until 1956. Hooker produced the solvents until 1973. In June 1997, Occidental sold the parcel 2 operations to Pioneer Chlor Alkali Company.

The major solid wastes generated at the plant include chlorinated organics, brine sludge, and asbestos from the production of chlorine, and generator lime and stripper-effluent lime from the production of chlorinated solvents. From 1929 to 1964 the chlorinated organics and brine sludge were discharged through the plant's outfall. From sometime between 1964 and 1970 to 1972, the brine sludge was discharged to a disposal barge. From 1972 until 1977, the brine sludge was discharged to either of two on-site disposal ponds. Since January 1977, the brine sludge has been filtered, the filtrate recycled into the system, and the sludge generated was disposed of at a landfill until 1995. Since then, the sludge has been recycled into a cement production process.

In 1948 the slurry effluent from the solvents plant was discharged directly to the Hylebos Waterway. From 1949 to 1952, the effluent was discharged to one of a series of holding ponds. Effluent from the ponds discharged to the Hylebos. From 1952 to 1972 the slurry effluent was collected in a barge that was dumped in deep water of Commencement Bay pursuant to Waste Disposal Permits issued by the State of Washington.

Between September 1949 and September 1979, several ponds were used for waste slurries. The majority of the wastes disposed of in the ponds came from the chlorinated organic solvent plant, calcium hydroxide slurries, effluent from the dehydro-chlorination stripper process, and residual bottoms from organic reclamation processes. Liquid effluent from the ponds was discharged to the Hylebos Waterway.

Other solids wastes, including concrete cell bodies, filtering media from the sodium chloride brine purification system and oil hydrogenation operations, asbestos, graphite pieces,

non-burnable wastes, lime, and dirt, were used for landfill along the Hylebos Waterway between approximately 1929 and 1971. This area has been defined as the 'N Landfill' and consists of the 300 feet of Occidental's plant that extends in the northwest direction, parallel to the Hylebos Waterway, from the Occidental/PRI property line. Some of these materials have been disposed of on the adjoining parcel, parcel three. This area has been under recent investigation which reveal that TCE, PCE, ethyl benzene, hexachloroethane, lead, 4-methylphenol, and two pesticides, DDD and DDE, were detected in the fill.

There were four waste piles, including a lead contaminated pile and an organics contaminated pile. Periodically, from about 1959 to mid-1978, waste graphite pieces were stored in a pile near the muriatic acid plant. In mid-1978 another pile, located west of the ammonia production, received lead pot skimmings and pieces of used graphite anodes contaminated with lead (levels ranging from 1,000 to 5,000 ppm). The graphite pile was placed on a sandy soil area, and there was no way of capturing runoff from this pile. The second pile received only non-dangerous wastes.

In 1975, there was an oily layer on the waterway located around the number two outfall. Occidental identified two sources of oil that were being released through the outfall; one was transformer and lubricating oil, and the second was chlorinated oil. Lyle Feller indicated that infrequently, he observed a little sheen on the water in the transformer yard. Water from the yard discharges through a drain that separates the oil and water and ultimately discharges only the water to the Waterway. Mr. Feller noted that the water could not be completely separated out, and that there was a small amount that could be released to the sewer.

Beginning in mid-1981, Occidental began reporting incidents. Several hundred reports of known and unknown quantities of TCE, calcium chloride, hydrochloric acid, muriatic acid, sulfuric acid, sodium hydroxide, and recycle and waste water has been released to the ground and the Hylebos Waterway.

Soil and groundwater investigations conducted in 1979 and 1980 revealed that soils and groundwater were contaminated with solvents. The consultant determined that 28,675 cubic yards of soil was contaminated with chlorinated organics and that sodium hydroxide from the caustic plant complex seeps into the Hylebos. The primary constituents that were flowing from the groundwater to the Hylebos include dichloromethane, chloroform, trichloroethylene, and perchloroethylene.

It appears from aerial photographs, that a berm was extended from parcel 2 along parcel 3 from about 1960 through 1974. Every indication is that the fill material forming the berm is from Occidental. I am unaware of any evidence that F.O.F., the owner of parcel 3, added any materials to the berm, although the existence of petroleum hydrocarbons in the berm suggests that possibility, as do aerial photographs.

While, for the purpose of investigation cost analysis, we attribute the possibility of lead releases to the tetra ethyl lead (TEL) plant on parcel 3, we note that the berm source material also contains elevated lead concentrations, as do intertidal areas along parcel 2. This indicates that

the fill material from Occidental plant at parcel 2 is a more significant source of lead than the TEL plant.

Pathways

Until 1949 there were several lines through which the plant's surface and process waste waters discharged to the Hylebos Waterway. Beginning in 1949 most of the process waste from the solvent's plant was discharged on-site. Process cooling waters, surface drains, and some process waste streams continued to be discharged through the plant's outfalls.

Since 1958 two outfalls were used for the disposal of liquid wastes to the Hylebos. Outfall 001 effluent consisted of cooling and wastewaters from the chlorine department, chlorine loading area, and solvents plant. This effluent contained small amounts of lime, caustic, organics, sulfuric acid, and free chlorine. From 1957 to until 1968, the average flow was approximately 4.3 million gallons a day. No data is available to indicate average flows between 1969 and 1971. From 1971 until the outfall was abandoned in 1979, the average flow was between 3 and 3.9 million gallons per day.

Outfall 002 discharged cooling and wastewaters from the chlorine, caustic, cell house, brine, ammonia, and muriatic acid departments. The average flow in 1957 was approximately 10.8 million gallons per day. No data is available of the flow between 1969 and 1971. From 1972 until 1994, the average flow ranged from 13 to 19 million gallons per day.

Chemicals known or suspected to be in the plant's effluent include carbon tetrachloride, hexachlorobenzene, hexachloroethane, chloroform, hexachlorobutadiene, hexachlorocyclopentadiene, tetrachloroethylene, trichloroethylene, cadmium, copper, lead, mercury, nickel, and zinc. The metals were regulated under the plant's NPDES permit. During the 1970s, the plant has had problems meeting the permitted limit for lead. Excursions have been attributed to overflows from the salt pad which reach the effluent. Lead also reaches the effluent from floor drainage in the cell house and surface drainage from an area used to break down electrolytic cell parts.

Tidal fluctuations affect the direction of groundwater flow. Groundwater flow does not consistently discharge to the Hylebos Waterway. During low tides, groundwater flow is towards the Hylebos Waterway in a northerly direction across the site.

Investigation Costs Impact

Since 1929, chlorinated organics were released to the Hylebos via the plant's outfall. Chlorinated hydrocarbons from the chlorine stripper effluent, detected in the effluent, include hexachlorobenzene, hexachloroethane, hexachlorobutadiene, chloroform, perchloroethylene, and trichloroethylene.

For 26 years the brine sludge was also released to the Hylebos via the plant's outfall. For five years after that time period, the sludge was disposed in holding ponds, and the effluent from the ponds was discharged to the Hylebos. The brine sludge is composed mainly of calcium

carbonate and magnesium hydroxide, with minimal amounts of metals, including lead, zinc, and copper, and organics.

For one year, the slurry effluent from the solvents plant was discharged directly to the Hylebos. For three years after that time period, the effluent was disposed in ponds, and the effluent from the ponds was discharged to the Hylebos. This waste stream was composed of dissolved calcium chloride, excess lime, inert inorganic solids, and high boiling chlorinated organic residues.

The ponds, which were utilized between September 1949 and September 1979, received wastes from several plant waste slurries. The major wastes received, as indicated above, were from the solvents plant. Other wastes include calcium hydroxide slurries, effluent from the dehydro-chlorination stripper process, and residual bottoms from organic reclamation processes. Analyses of the ponds in 1950 revealed metals (zinc, copper, lead, and nickel) and chlorinated organics (mainly trichloroethylene, perchloroethylene, pentachloroethane, and hexachloroethane). Analyses of the ponds in 1972 revealed additional constituents including cadmium and oil and grease.

For approximately 43 years, solids wastes, including concrete cell bodies, filtering media from the sodium chloride brine purification system and oil hydrogenation operations, asbestos, graphite pieces, non-burnable wastes, lime, and dirt, were placed along parcels 2 and 3 as fill along the Hylebos Waterway. This area has been under recent investigation which revealed that TCE, PCE, ethyl benzene, hexachloroethane, lead, 4-methylphenol, and two pesticides, DDD and DDE, were detected in the fill.

During the 1970s, the plant had problems with meeting their permit limitation for lead. Excursions of the limit were attributed to overflows from the salt pad, floor drainage from the cell house, and surface drainage from an area used to break down electrolytic cell parts.

Potential releases of PCBs from Occidental's plant are not considered to be significant, although there have been reports of transformer leaks and reported releases of oils from the transformer area.

We have attributed to Occidental a major release, given its history of process discharges. Occidental is the major source of chlorinated organics in the Mouth of the Waterway. We have attributed a significant release of chlorinated organics to the solvents plant as a separate attribution, given that it was by far the major source of solvents in the Waterway. We have attributed significant releases of other contaminants to the Occidental plant, including modest to significant releases of metals, at elevated concentrations, modest releases of chlorinated organics from chlorine production and from groundwater releases subsequent to the solvent plant closing in 1973, and minimal releases of PCBs. In light of the extensive use of oils and evidence of a release, we have attributed a minimal release of PAHs to Occidental.

Occidental Chemical also is associated with wastes disposed of or used as fill on a number of other parcels, including parcels 3, 10c/13 (possibly including 15 and 16), 31, and 46. The disposal of Occidental sludges on other parcels provides a potential pathway for release of

organics and extractables from the Occidental operation to other portions of the Waterway. I have attributed minimal amounts of releases of various contaminants, including organics from these sites. I have assumed as the number of years the earliest date of disposal to remediation.

We have distinguished operations of the solvents plant during the time it was operated as part of the joint venture of Hooker-Detrex. We also have taken into account the fact that operations of the solvents plant occurred during a limited time period. Thus, for the period during which the solvents plant was in operation, we have assigned a higher RM and SQO score than during the other periods of operation.

Ohio Ferro-Alloys (OFA) owned the property and operated a foundry on parcels 28/70 from 1941 until 1974, when it ceased operations and sold the property back to the Port of Tacoma. OFA may have had some involvement with parcel 27, but its allocation is based on activities on parcel 28/70.

From 1941 to 1949, OFA operated a smelter in which ferro chromium and coal were smelted in an electric furnace and reduced to a ferro chromium metal. The plant also manufactured ferro silicates. In 1948, the plant began producing briquettes containing silicon, chrome and manganese. From approximately 1952 until 1974, the plant produced ferro silicon and pure silicon. Plant facilities included railroad spurs, a furnace, and transformers. Chromium ore or silica (as quartzite), coke or coal, and iron scrap were the primary raw materials used by the smelter. Wood chips may also have been used. Most raw materials were stored outside in piles. Piles were washed down to prevent small dust particles from entering the furnace. OFA's operations produced a chrome-containing slag waste. Slag was sold or disposed on site. According to OFA, process wastewater was limited to non-contact cooling water, which was evaporated and not discharged. However, aerial photos and other evidence indicate that wastewater flowed off the site towards the Kaiser Ditch. OFA demolished the facility after it ceased operations. Demolition debris and residual raw materials were left on site when it was sold to the Port.

Carbon tetrachloride, stored in barrels, was used to clean electrical equipment.

Information indicates the OFA plant released considerable smoke and soot to the air. After OFA installed cyclone separators, dust collected in the equipment was dumped in piles on the ground near the plant.

A slag/soil material found on the site contained OFA slag (30-35%), Asarco slag (1-2%), organics (8-10%), and miscellaneous debris (1-2%). The remainder of the material was soil. Asarco slag was more prevalent in wood chip areas; OFA slag was more prevalent with quartz debris. An investigation in 1990 detected high levels of arsenic, chromium, cadmium, mercury, and lead in the slag area, located in the east central portion of the site. Arsenic was detected at high levels in ditch water. Groundwater concentrations of arsenic, chromium, copper, and nickel exceeded MTCA surface water criteria.

Contaminants associated with OFA's operations on this parcel include metals (chrome, iron, furnace slag), PCBs (electrical equipment), and PAHs (coke, coal, briquettes, furnace slag).

Pathways included surface water discharges of runoff and of process wastewater, primarily non-contact cooling water. The available information suggests that wastewater from OFA operations was discharged to the Hylebos via a ditch. Aerial photos and other evidence indicate wastewater flowed off the site towards the "Kaiser" Ditch. Wastewater discharge volumes ranged from 50,000 gpd to 75,000 gpd. There is no information to estimate the volume of surface water discharges.

PAHs and metals released from materials stored or disposed on site may have reached the waterway via surface runoff. Runoff likely included water used for dust control on piles of raw materials, including coke, coal, chromium ore, and iron scrap. Surface runoff likely was contaminated by chrome-containing slag waste disposed on site, or by cyclone dust dumped on site. Water that flowed over the railroad tracks may have become contaminated with PAHs. PAHs were detected in site soils at elevated levels, primarily in the area containing charcoal briquettes, but also related to a timber with a creosote-like odor and related construction debris. Approximately 4,100 cubic yards of PAH-contaminated material was located on site.

We have attributed to OFA appreciable releases of metals and PAHs in elevated concentrations. We also have attributed a modest release of PCBs from this operation.

Ole & Charlie's Marinas, a first round cash-out party, has operated a boat storage and launching marina on Parcel 68a since 1975 and on Parcel 68 since 1985. The parcels are owned by Donald Olson, president of Ole & Charlie's.

Potential sources of contaminants are associated with use of underground storage tanks. A 1990 report indicates that the area of the marine haul-out (the area between the boat trolley tracks and near the boat winch house) contained soils stained with paint residues, and appeared to be soaked with lubrication oil from the electric winches, cables, and boat trolley. Based on a review of the Tacoma-Pierce County Health Department Drainage Map it appears that this area would drain directly to the Hylebos. Soil samples collected in this area revealed lead contamination, and one sample contained detectable concentrations of petroleum hydrocarbons. Trace concentrations of ethylbenzene and xylenes were found just east of the fuel underground storage tanks.

Since at least 1960 three catch basins have existed on the property. Surface water runoff drains to a storm sewer that discharges to the Hylebos Waterway through an outfall in the northwest corner of the property. In 1991 and 1994, Ecology detected metals (arsenic, copper, and zinc) in the sediments of the catch basins in exceedance of sediment quality objectives. In 1994, Ecology also detected PCBs in the catch basin sediments. The only activities that take place in the areas where the catch basins are located are dry boat storage and car parking.

Metals contamination identified in the catch basin sediments are typically associated with boat repairs, specifically, sandblasting and scraping of hull paints. Ole & Charlie's Marina only stores boats at their marina. No major repairs are conducted at their facility. Ole & Charlie's Marina attributes the contamination to AK-WA Shipbuilding's operations across the waterway. Ole & Charlie's contends that AK-WA's sandblasting operation causes airborne particles to land on the property and boats at Ole & Charlie's Marina when the wind is from the southeast or

southwest. We have to assume a stormwater release of metals via the catch basins. The SQO impact was significant because metals were detected in the catch basin sediments above SQOs. The evidence does not point to a specific source of metals contamination as a result of activities associated with Ole & Charlie's Marinas. Nevertheless, we are assuming that there may be a possible source from this parcel.

PCBs have been detected in the catch basin sediments. Although there is no evidence of sources of PCBs from the property, the presence of PCBs in the catch basins indicates that the parcel may be a source. In addition, Ole & Charlie's has been the sole owner and operator of the parcel during the past 21 years. As such, it must take responsibility for any PCBs that have drained from its property during that time, even if its activities did not necessarily generate PCB releases.

The investigation cost share for Ole & Charlie's Marinas is based on approximately twenty-four years of ownership and operation and an assumption of modest releases into the Hylebos. It also takes into account the uncertainty regarding whether, and to what extent, the activities on this parcel may have created a source of PCBs or metals.

Olin Corporation, a second round cash-out party, operated an aluminum reduction plant on parcel 30 for during World War II. The U.S. Government, either through the Defense Plant Corporation ("DPC") or the Reconstruction Finance Corporation ("RFC"), owned the parcel⁵⁰ from October 1941 until November 1947. The plant began operations in September 1942 and began operating at full capacity in March 1943. Operations ceased after July 1945.

While the facility was operated as Plancor 245, pot skimmings were reprocessed to retrieve valuable cryolite and recycled back into the process. Failed potliners were generally put in the kiln for disposal. Kaiser indicates that spent potlining, containing approximately 33% carbon, was disposed on site between the time the facility opened⁵¹ until it was shut down in 1958.

We have attributed to Olin and the U.S. Government Defense Plant Corporation investigation cost shares based on modest releases of PAHs, phenols, metals and, possibly, PCBs from this World War II plant. We note that high concentrations of PAHs were not present in releases from this plant during Olin's operation, since wet scrubbers were not being used. Air emissions potentially placed PAHs in and around the Hylebos Waterway watershed. The SQO score takes into account the fact that dredging of the Hylebos likely removed contamination from these operations and that the contaminants released from the plant are very likely no longer present in Hylebos sediments.

⁵⁰ The property originally associated with 3400 Taylor Way also included what is now referred to as Parcel 29 and Parcel 32 and part of Parcel 31.

⁵¹ The spent potlining management facility closure report (c. 1986) states that SPL had been stored outside since 1943. See KAI391674.

We have not attributed any share to Olin Corporation relating to its association with parcel 29 or 32.

Oline, Don alone, or with his wife Alba or with Richard, Brad (deceased) or Ron Oline, owned and/or operated on parcels 10c/13 for 17 years, parcel 15 for 13 years, parcels 49, 50 and 51 for 4 years, parcel 52 for 9 years, parcels 52a and 53 for 15 years, parcel 16 for 13 years, parcel 46 for 4 years, parcels 48 and 57 for an unknown time period, and parcel 62 for 4 years. Oline has conducted various operations and dumping activities on many of these parcels. Much of the dumping was of auto fluff, which is an identified source of metals, phthalates, and PCBs. We have attributed minimal to modest releases of metals and PCBs from the various parcels as appropriate.

During the time Don Oline owned parcel 10c/13, he performed or allowed dumping of various industrial wastes on the property. Releases of organics (chlorinated hydrocarbons) and metals are associated with Hooker's disposal of contaminated waste lime sludges. The material was deposited for approximately four years in the marshy area of this parcel that was reported at one time to be draining to the Hylebos. Auto fluff and automobile demolition debris from General Metals was also used as fill on the property between 1970 and mid-1976. We have assumed a minimal release of PCBs, organics and metals, which are associated with auto fluff and demolition debris, to the Hylebos via stormwater. Some of the dumping may have extended to parcels 15 and 16. A 1985 Preliminary Assessment performed by EPA with regard to a "Don Oline Landfill" places the location at 1801 Alexander Avenue, which would actually be Parcel 16. We are unaware of specific evidence other than this document that would place fill at parcel 16.

Based on information in the record, it appears that there has never been any pathway from parcel 15 to the Hylebos Waterway.

As noted above, from 1972 until 1975, while parcels 10c/13, 15 and 16 were owned by Don Oline, an area extending over one or more of these parcels was used for disposal of waste sludges from Occidental. The waste sludges were generated from the solvents plant and from the dredge spoils from Occidental's docks. The dredge spoils and solvent sludges were contaminated with chlorinated hydrocarbons (trichloroethene and tetrachloroethene), asbestos, and heavy metals (lead, copper, cadmium, mercury, and chromium). Approximately 13,000 tons (2,000 tons were dredge spoils) of wastes were disposed at this site. Occidental disposal ceased in 1975 and all wastes have been covered by clean fill. We have assumed minimal releases of metals and organics from this activity and a possible release from one or more of these parcels into the Hylebos.

Occidental Chemical disposed or arranged for disposal of about 1700 tons of brine sludges and wastes from its solvent (trichloroethene and tetrachloroethene) production on parcel 46. Sludge components include calcium carbonate, magnesium hydroxide, sodium chloride, strontium and lead. Solvent plant wastes included chlorinated organics, asbestos, lead and copper. In the mid-1980's, groundwater at the site was contaminated with trichloroethene and tetrachloroethene. We have assumed that Oline was associated with this disposal.

We have not identified activities by Don or Ron and Brad Oline in relation to parcels 48 and 48a.

Between 1974 and 1975, during Don Oline's ownership, portions of Parcels 49, 50 or 51 were filled with auto fluff from General Metals.

There is a potential for releases of metals from ship repair activities conducted by Don Oline d/b/a Stone Investments on parcels 52a and 53. Don Oline, d/b/a Stone Investments, operated a heavy equipment and machinery storage facility and boatyard on the parcel. Oline's use of the property was in violation because he never obtained a permit. On at least one occasion, sandblasting activities occurred directly over the water, and sandblast/paint dust was observed being blown into the waterway. Metal contaminants are associated with sandblasting and painting operations. During a site inspection paint waste and batteries were observed being stored all over the facility. In addition, a lead-lined scrap tank from a pulp mill was stored at the center of the site. There is also a potential for releases of metals via surface water runoff from the site from the storage activities. A soil sample collected from a demolition area in the center of the site contained zinc in exceedance of the SQO. We have also assumed that there was a potential for release of oil and grease contaminants via surface water runoff, from the storage of waste oils that was noted on the parcel during a site inspection. We have attributed separate shares for Oline as an owner and Stone Investments (another Exhibit D party) as an operator.

We have not identified any specific activities associated with Don Oline at parcels 57 and 62.

Oline, Ron, Please see discussion under Johnson, Judy.

Olson, Don has been the owner of Ole & Charlie's and of parcels 68 and 68a for 23 years. He is attributed an owner share related to these parcels.

Pacific Marine Repair conducted tank inspections and operated a parts fabrication for ship repair facility on parcels 60 and 61 for 7 years. Raw materials used at the facility include a liquid malic acid that has heavy metal (arsenic (1.5 ppm max) and lead (5 ppm max)) constituents. In 1990 Ecology found metal shavings scattered inside the metals shop, and an old mobile compressor stored in the yard had evidence of past oil leaks to the gravel.

We have attributed minimal releases of metals and PAHs for this entity.

Pan Pacific Trading was a co-owner of parcels 22, 22a, 22b for 30 years. It also operated a log yard on parcel 24 for an estimated 8 years. We have attributed modest releases of PAHs and phenols to these operations.

Pederson Oil, Inc. leased two fuel tanks for petroleum storage on parcel 37 between 1980 and 1984. The tanks were removed in 1984. We have not identified any releases from Pederson's operations.

Petroleum Reclaiming Services, Inc. (Coastal Tank Cleaning Services) (PRSI 2), a first round cash-out party, has operated on parcel 27 for the past 13 years after it was purchased by Jack Johnson, Tom Smith, and Gary Smith, in October 1987. The cash-out recommendation did not assume that PCB's from PRSI's operations are proximately linked to any areas of subtidal remediation. However, the possibility of releases of PCB's from this parcel during this period of PRSI's ownership and operation were taken into account. Modest releases were assumed.

Poligen Corporation For a brief period in the 1970's, Poligen owned one parcel of land at parcel 15. The land owned by Poligen was sold to Solidus Corporation within six months of acquisition. Poligen began operating a chemical and petroleum recycling facility on the parcel in the 1970s and operated for approximately 14 years.

By the early 1970s the filled property had been developed and used primarily for the purpose of storing and distributing petroleum products such as heating oil, base oils, and marine lubricants. Initially, Poligen purchased tanks and other related equipment and over time improved the site with Lilyblad Petroleum. Records indicate that these tanks contained a variety of materials including mineral spirits, used oil, and solvents. Poligen's operations consisted of acquiring assets like storage tanks and buildings and leasing these assets to other corporations (e.g. storage tanks to Lilyblad) for their use. Poligen leased warehouse storage space to companies like Shell Oil, British Petroleum, Texaco and other major oil companies. Poligen also collected mixtures of slop oils (gas, oil, and water) generated by petroleum refineries, and reprocessed the off-specification fuel into petroleum products such as naphtha, dark diesel, and cutter stock. Poligen also collected, stored, and processed on-specification used motor oil that was sold as bunker fuel to the marine transportation industry. In July of 1987 Poligen was dissolved and Northwest Processing took over Poligen's participation in the slop oil and waste oil reprocessing operations.

Based on information in the record, it appears unlikely that there has ever been any pathway from the site to the Hylebos Waterway. Given this uncertainty, we have attributed a minimal release of various contaminants to Poligen and other owners and operators on parcel 15. We also have attributed a minimal release of PAHs and metals associated with disposal by Poligen of sludge at the Coski Landfill.

The Port of Tacoma has owned and leased numerous parcels along the Hylebos. Port of Tacoma is the biggest promoter of the Waterway. The Port has not participated in this allocation process but has allowed its employees to be interviewed. Generally, standard leases between the port and its lessees place the responsibility for site maintenance on the lessees. However, the Port is not a passive owner, and we have attributed to it shares of approximately 20% of each of the parcel operations undertaken on the parcels which it owned. With respect to certain parcels, such as parcels 1 and 6 (referred to by the Port as parcel 4 in some documents), the Port has taken a more extensive role in maintaining the sites and has become involved in environmental investigations and remediation. It has been allocated a share of some of the log yard cleanups. The investigation cost spreadsheet lists the parcels that were owned by the Port. While I have not reviewed or analyzed contracts and agreements, it is my understanding that, under the terms of a consent decree, Port of Tacoma has agreed to assume remediation liabilities (including

sediment) for all parcels that it transferred to the Puyallup Tribe of Indians (including 28, 70, 34, 35, 40, 67, and 68-A).

Parcel 1 -- In 1960, the Navy sold the property to the Port of Tacoma. The Port of Tacoma inherited the electrical power and transformer system from the Navy.

In December of 1992, the Department of Ecology requested that the Port clean up sandblast grit and contaminated catch basin sediments. Subsequent to the clean up, in September 1993, sediments from twenty-seven catch basins, which drain to the Hylebos, were sampled. Results revealed that lead, copper, and zinc were detected and averaged approximately 300, 470, and 830 ppm, respectively. Levels for lead, copper, and zinc were detected the highest at 650, 1230, and 1450 ppm, respectively. PCB concentrations ranged from 130 ppm to 1,500 ppb. Ecology determined that it was possible that the catch basins became recontaminated from inflow of contaminated sediments from the storm lines which had not been cleaned or residual sandblast grit on the surface of the industrial yard.

The Port of Tacoma, as owner of this parcel for 40 years (since 1960) is responsible for potential releases from its tenants for metals and oil and grease constituents. The Port is also responsible for potential releases from the transformer system in the yard. In approximately 1989 or 1990 the transformer system was upgraded by the Port to contain less than 50 ppm of PCBs. In 1992-1993, the Port cleaned up the sandblast grit that had contaminated the catch basin sediments. Testing subsequent to the cleaning revealed that the sediments were still contaminated, and thus were a continuing source of contamination to the Hylebos Waterway.

Parcel 4 -- The 3.95 acres were conveyed to the Port of Tacoma on August 30, 1966. The petroleum storage facilities were used and leased by the Port of Tacoma from 1966 to 1983. Spills of petroleum products have been documented at this parcel. In response to a leaking valve noted in March of 1981, the Department of Ecology contacted the Port of Tacoma regarding the need to seal the tank farm floor.

Parcel 5 -- The Navy owned this parcel until January 1960 when it sold it to the Port of Tacoma. The Port of Tacoma currently owns this parcel and leases the property to McMillan Piper and K & M Metals and Field Corporation.

Parcel 6 -- In 1960, the Port of Tacoma purchased 8.11 acres along the Hylebos Waterway. The government retained 4.83 acres of the upland portion of the parcel for use as the Navy and Marine Corps Reserve Center.

Parcel 8a -- The Port of Tacoma owned this property for an unspecified period.

Parcel 10 -- the Port of Tacoma currently owns this parcel and has owned it since 1977. There is no information in the record regarding operations at this parcel. Accordingly we have not attributed any portion of investigation or remediation costs to the Port of Tacoma from this parcel.

Parcel 15 -- the Port of Tacoma currently owns this parcel and has owned it since 1977. Given the fact that there is no confirmed pathway from this parcel to the Hylebos, we have not attributed any portion of investigation or remediation costs to the Port of Tacoma from this parcel.

Parcel 28/70 -- The Port of Tacoma purchased the property in 1940. The Ohio Ferro Alloys (OFA) Corporation owned the property and operated a foundry at this location from 1941 until 1974, when it ceased operations and sold the property back to the Port of Tacoma. From 1974 until 1989, the Port leased approximately 20 acres of the site to various lumber companies for use as a log sort yard. It is our understanding that the Port owned these parcels until 1992.

Parcel 33 -- From 1959 to 1967, parcel 33 was owned by the Port of Tacoma. The site was first used as a log sort yard and sawmill in the mid-1960's when it was developed by Cheney Lumber. Louisiana Pacific purchased the parcel in 1967 and continued to use it for the same purposes.

Parcel 34 -- We have assumed that the Port owned this parcel from 1959-1967, but have not identified any operations or releases from this parcel.

Parcel 35 -- This parcel apparently has been used for Weyerhaeuser's log scaling (measuring the length and diameter of the logs) operations since 1972 when Weyerhaeuser began leasing the parcel from the Port of Tacoma. Our understanding is that the Port owned this parcel from 1972-1992.

Parcel 36 -- The Port of Tacoma has owned this property since approximately 1940. Dredge material from the eastern end of the Hylebos Waterway may have been placed on this parcel between 1964 and 1966. In 1987, two barrels of solvents were illegally dumped in the ditch along Marine View Drive. The Port contracted for removal of the solvents and one barrel of contaminated bark. There is no indication as to who was responsible for dumping the material. A 1,000-gallon underground storage tank was removed from the southeastern side of the parcel circa 1990 or 1991. The Port conducted the remediation associated with the storage tanks. Samples collected from the excavation contained TPH above state cleanup levels.

Parcel 37 -- The Port owned this parcel until 1967 when it was sold to Hart Construction.

Parcel 38 -- Streich Brothers purchased part of the parcel in 1966 from the Port of Tacoma.

Parcel 40 -- The Port of Tacoma owned the property from 1968 until 1992 when it was transferred to the Puyallup Tribe. During the Port's ownership, the parcel was leased to Mitsubishi International (1968-1970), Puget Sound Log Traders (1972-1973), and Manke Lumber (1974-1976).

Parcel 41 -- Prior to 1968, the property was owned by the Port of Tacoma.

Parcel 42-44 -- Manke purchased 1750 Marine View Drive, part of parcel 42, from the Port of Tacoma in 1964. The Port of Tacoma owned another portion of Parcel 42 until 1988, when it was sold to Manke Lumber. Manke had been leasing that portion of the parcel since 1976. We assume that the Port owned parcel 44 from 1959-1988.

Parcel 46 -- The Port of Tacoma has been the owner of part of Parcel 46 since an unknown date.

Parcel 48a -- The Port of Tacoma owned the property for an unknown period of time. There was no information available regarding this site.

Parcel 60, 61 -- The Port of Tacoma owned the parcels in 1943 and 1944.

Parcel 67 -- From some unknown time period (presumably early 1970s) until approximately 1992 the Port of Tacoma owned the property. In approximately 1992 the Puyallup Tribe of Indians acquired the property. Beginning in 1974 until an unknown time period, Foss Maritime leased the log yard from the Port of Tacoma, and Cascade Timber operated the facility. Manke Lumber was a tenant on this parcel during 1977-1978.

Parcel 68/68a -- The Port of Tacoma owned parcel 68A from some unknown time period (we have assumed 1975) until 1992 when the parcel was acquired by the Puyallup Tribe.

Parcel 69 -- Milgard Manufacturing purchased the parcel from the Port of Tacoma in 1977.

Parcel 71 -- The Port of Tacoma owned this parcel, but, to our knowledge, there have been no on this parcel.

Parcel 74 -- It appears that the Port of Tacoma has owned the property since 1970. In 1975, Gitt Brothers was leasing this property from the Port. Burien Bark Supply purchased the Gitt Brothers operation in 1980. Burien Bark Supply later changed its name to Tacoma Bark Supply, which by 1991 had changed its name to Bark and Garden Center, Inc. None of these parties is on Exhibit D. In 1968, the Port granted permission for B&L Trucking to construct, maintain and use an access road on the parcel. Potential sources of contamination related to this parcel appear to be limited to the underground storage tanks and associated contaminated soils. Contaminants associated with these facilities include VOCs (gasoline) and PAHs (from diesel and gasoline).

Parcel 78 -- Hylebos Waterway Submerged Lands. Parcel 78 is the designation for the Hylebos Waterway submerged lands, which we assume includes subtidal sediments in the Waterway. This "parcel" is not a source of sediment contamination per se. However, as an owner of the sediments to be cleaned up, the Port is the beneficiary of the cleanup and has an equitable obligation in its own right to remediate the sediments. As discussed

above, we have attributed approximately 7.5% to the Port in regard to its ownership of the sediments.

According to Striplin Environmental's Summary of Existing Information, between 1915 and 1918, the Waterway District acquired several parcels of tideflat lands from private owners and dredged the waterway through them. The Waterway District transferred ownership to its successor, the Port of Tacoma, in 1959.

In 1920, dredge spoils from the Hylebos Waterway created the Peninsula near the 11th Street Bridge. By the 1940s, a sawmill and dock extending along the Hylebos Waterway occupied the Peninsula. Logs for the sawmill were stored in the intertidal area to the north of the Peninsula. Sawmill operations ceased by the late-1940s. Since then, there has been no apparent industrial use of the property, except maritime towing equipment and storage and docking operations in the late-1960s and 1970s, probably related to log storage. Log storage continued in the intertidal areas of the property from the 1930s to the present. A marina was constructed on the northwestern end of the property by placement in the 1960s.

Subsurface investigations revealed that crushed drums were buried at two separate locations, and a small area of buried oily soil and sawdust was noted. The Port of Tacoma cleaned up the Peninsula. Analyses of soils indicated that soils contained TPH above cleanup levels in some of the excavation samples. Residual petroleum hydrocarbon product associated with the oily sawdust was also present on the groundwater surface in the vicinity of the north end of the Peninsula.

The pathway identified from the property is tidal flushing to the Hylebos Waterway.

Portac (West Coast Orient) operated log yards on parcels 28/70 for 1 year, 71 for 25 years and 26 for 6 years. We have attributed modest releases of PAHs and phenols from these operations.

PQ Corp has owned and either leased or operated on portions of parcel 9 and 9a since 1941. Most of the lessee activities appear to relate to vehicle or equipment repair and maintenance or waste separation.

PQ also conducted its own operations. In 1987, PQ was producing liquid sodium and dry silicate. Equipment included an open hearth glass furnace, two pressure dissolvers, and two steam boilers. High silica content sand is reacted with soda ash in the presence of steam and high pressure to form silicate bricks. Raw materials included soda ash, caustic soda (50%), ethylene glycol, and sodium carbonate. Materials used in maintenance included acetylene gas, liquid wrench, plastic steel hardener, silicone sealer, and WD-40. General materials on site included gasoline, kerosene, propane, fuel oil #2, synthetic thinner, lacquer thinner, and Roundup herbicide. Hydrochloric acid was being used in the laboratory. In 1982, there were 12 storage tanks for sodium silicate (total capacity 103,800 cubic feet), two fuel tanks with a combined capacity of 20,450 gallons and one 5500 cubic foot soda ash tank.

A 1993 Notification of Dangerous Waste Activities form indicates that PQ generated waste from solvent cleaning operations. Some of the waste included mineral spirits, oil, water, cadmium, and lead. The remainder of the waste contained mineral spirits, oil, water, lead, benzene, and tetrachloroethylene.

A storm line was constructed around 1941 and was relocated in 1991. The plant was connected to the sanitary sewer in 1975. According to a 1982 inspection report, the boiler blowdown discharge to "PQ Pond" was at one time under a state waste discharge permit. This permit expired in 1971 and had not been renewed by Ecology as of March 1982.

A 1990 letter from WDOE implies that PQ had an unpermitted high pH discharge to the Hylebos. It appears that as of 1990 the company was discharging process waste to the storm drains. A 1990 inspection indicates that the site drains to the Hylebos via a wetland and storm drain. Process water was composed of a small quantity of recycle water containing silicates and boiler blowdown. This was being discharged to the wetland. The wetland drains to the city storm drain that empties into the Hylebos under the 11th Street Bridge.

We have little information on contaminants of concern from this operation. We have attributed to PQ modest releases of PAHs and metals from vehicle and equipment use and fuel storage.

PRI Northwest leased parcel 3 from FOF in 1978. PRI acquired ownership of the parcel in 1982 and continued to operate on the parcel until 1985. In August 1997, Occidental acquired the parcel from PRI. PRI Northwest also leased tanks on parcel 4 for 5 years. As discussed above, FOF and PRI Northwest operated a bulk fuel storage and distribution facility. In addition, during the 1970s and early-1980s topping and tetraethyl lead (TEL) plants were operated. By April 1983 PRI had discontinued the storage and distribution of gasoline. Thereafter, and until 1985 when all operations ceased at the property, the parcel was only used intermittently for the storage and distribution of diesel fuel.

Please see the discussion under FOF. As we did for FOF, for purposes of investigation costs, we have assumed the potential for minimal releases of PAHs and petroleum-related organics. We also have taken into account the fact that PRI's operations on the parcel after 1985 were significantly diminished. We note the possibility of chlorinated organics.

Rail & Locomotive (wholly-owned subsidiary of Joseph Simons & Sons), a second round cash-out party. Please see discussion under Joseph Simons & Sons.

Reichold leased a tank on parcel 4 for 2 years for the storage of calcium chloride. We have not attributed any investigation cost share for this activity. Since 1956, Reichold also has owned and operated a plant on parcel 21c for the manufacturing of organic and inorganic chemicals, resins and treated fiberboard. Products included formaldehyde, formaldehyde catalyst, pentachlorophenol, butyl phenol, resins (urea formaldehyde, phenol formaldehyde, polyvinyl acetate, polyester, and polyurethane foam resin), and treated fiber products.

The primary contaminant in the process discharge from this plant is phenol. However, available evidence suggests that Reichold's plant has not discharged to the Hylebos. An April 16, 1957 Pollution Control Commission memo to file indicates that PCC staff had conducted an inspection of the Reichold facility in response to several reports that Reichold was discharging wastes into the Hylebos. The inspectors confirmed that the facility drained by way of storm drains to the Port Industrial Waterway. At no place did the inspectors note any way in which drainage from a swampy area surrounded by Taylor Way, Lincoln Avenue, and Reichold property could reach the Hylebos. Other, later Ecology documents also indicated disposal to the Port Industrial Waterway. Accordingly, we have not attributed Reichold any investigation cost share.

Ryder Truck Rental, a first round cash-out party, leased a portion of the parcel 19 from Land O'Lakes/CENEX Feeds, Inc. to operate a truck maintenance facility from 1987 to 1991. The primary potential releases of contaminants are associated with the truck maintenance facility. We have attributed a modest release of metals and PAHs relating to this activity.

Seaport Bark Supply was a tenant from 1985 to 1988 on parcels, 22, 22a and 22b, and operated a bark separation process.

Seaport processed wood wastes from log yards in the Tacoma area that contained slag. Wastewater that was generated from the bark washer contained arsenic, lead, and zinc. The wastewater was discharged to a series of settling ponds and then ultimately to the Hylebos Waterway. The wastewater was discharged without a permit. Sediment sludges from the ponds were stored near a ditch that flowed through channels dug in the soils to the Hylebos Waterway. In September 1986, the volume was estimated at less than 10 gallons per minute. The ponds were closed in October 1988. Investigations in 1989 revealed that water from the ponds and the outfalls contained arsenic, copper, lead, and zinc at levels exceeding regulatory criteria.

The groundwater also was contaminated by relatively low concentrations of metals. A plume of contamination was found within the old channel of the Lincoln Avenue ditch.

Inasmuch as this was an active processing operation, undertaken after it became known that woodwaste and slag posed a potential arsenic threat, we have attributed to Seaport a modest release of metals, as well as PAHs and phenols.

Sierra Sandblasting and Paint operated on parcels 11 and 12 for about 4 years. Sierra Sandblasting's operations consisted of sandblasting and painting of metal, heavy equipment, and tanks. Material that was sandblasted was discharged directly to the ground. Contaminants of concern associated with these types of activities include metals. We have assumed modest releases of metals above regulatory levels from this operation.

Smith, Wendell Please see discussion, above, under May, Annon (PRSI). Wendell Smith shares in the allocation attributed to that entity

Solidus Corporation is associated with parcel 15 for 18 years. Please see discussion, above, under Poligen.

Sol-Pro (Lilyblad Petroleum) has operated a facility at parcel 16 for the past 11 years. It also used and leased tanks on parcel 4 for 10 years. The Sol-Pro facility on parcel 16 was constructed in 1987 and operations began in 1988. The facility currently reclaims solvent from blended or dirty waste solvent. The reclaimed solvent is returned to the generator or sold. Any treatment residual is disposed off-site. Evaporation/condensation units are used to recover purified solvents. Chlorinated waste solvents and non-chlorinated waste solvents are processed at the facility. Currently, chlorinated solvents are processed infrequently. The two types of solvents are handled separately.

Contaminants of concern associated with activities on the parcel include organics, PAHs, and heavy metals. Sol-Pro's operations consisted of reclaiming chlorinated and non-chlorinated waste solvents. Wastes produced during the treatment processes are either treated or disposed off-site. Of the available information, there is no indication of a release from these activities. During a 1990 inspection, sampling of groundwater revealed that organic compounds were not present. Oil and grease were detected in two monitoring wells. There is no information regarding whether groundwater from the parcel flows to the Hylebos.

Based on documents in the record and the Tacoma-Pierce County January 1995 Drainage Map, the location of Sol-Pro's drainage system is not clear. Thus, it is not clear whether drainage from this system ultimately flows to the Hylebos or Blair Waterway. According to Ron Robinson, a Department of Ecology inspector, drainage from the Sol-Pro site would more likely flow towards the Blair Waterway.

In light of the uncertainty regarding drainage and release of contaminants, we have attributed only a minimal release of low concentration organics and metals to the Sol-Pro operation on parcel 16. We also have attributed to Sol-Pro, a minimal release associated with use and lease of tanks on parcel 4.

Sound Refining (Crysen Corp.), a second round cash-out party, has owned and operated the refinery on parcels 58 and 59 for the past 18 years. Please see discussion, above, under Kalama Chemical.

SRS Properties, Inc./The Sussmans, second round cash-out parties, owned parcel 45 from 1965 until 1992 and leased it to General Metals of Tacoma for that period of time. The Sussmans owned the majority of General Metals' stock until February 1981, when they sold all of it to Acme Trading. After the stock sale, the Sussmans' only involvement with the site was as landlords through SRS Properties. General Metals purchased the property in 1992 and continued its operations.

Please see the discussion, above, under General Metals for further details of the operations at Parcel 45.

The investigation cost share for SRS/Sussmans takes into account SRS' ownership of Parcel 45 property from 1965 until 1992 and the Sussmans' ownership of the majority of General Metals' stock until February 1981, when they sold all of it to Acme Trading. Although the

Sussmans owned the majority of shares of General Metals, I am not attributing them a share as an operator. However, given their relationship with the business, they cannot be considered passive owners of the property. Taking into account the likelihood that more significant releases occurred during the period prior to 1992 the overall investigation cost share is 20% of the parcel 45 investigation cost share.⁵² In my view, this represents a fair owner share, taking into account the involvement of the Sussmans in the business.

Stone Investments operated on parcels 52a and 53 for the past 17 years. Please see discussion, above, under Oline, Don.

Stracke, Clarence operated Stracke Fabricators, a metal fabrication facility, on parcel 65 for 6 years. Wastes generated from the operations included paint, metals, and solvents from the metal painting and welding activities. Pathways from the site have not been documented. We have assumed that there was a potential for stormwater to flow through the storm sewer system located along Marine View Drive that discharges to the Hylebos Waterway through outfalls Nos. 11 and 13.

There is no information in the record regarding documented spills or releases from this parcel. We have assumed that there was a potential for very minimal releases of metals and organics to the Hylebos via stormwater runoff.

Streich Brothers, a first round cash-out party, owned and operated on parcel 38 for 30 years. Activities associated with Streich Brothers operations which may have potentially released contaminants of concern to the Hylebos include: the installation of an oil/water separator in the culvert which drains to the Hylebos; use of an underground storage tank; the steam cleaning sump; and the hydraulic systems. However, we note that no specific evidence indicates that contaminants associated with these activities would have reached the Hylebos.

Streich Brothers is associated with metals, petroleum hydrocarbon and volatile organic contaminants. Soils that were contaminated by petroleum hydrocarbons and organics were collected at depths within groundwater ranges. Although it is not known whether the groundwater was affected by the soil contamination and the direction of groundwater flow beneath the site is not known; we have inferred that, based on the close proximity of the tank to the Hylebos, and the fact that soil contamination was detected at depths within groundwater ranges, these contaminants may have reached the Hylebos via the groundwater.

In addition, we have inferred that since an oil/water separator was installed in the culvert system to treat stormwater prior to discharge to the Hylebos, that the stormwater contained petroleum hydrocarbons that were being released to the Hylebos.

We have assumed releases of aromatic hydrocarbons via the soil and/or stormwater and organics via the soil. Average petroleum hydrocarbon levels detected in the soil were above regulatory levels and levels of hydrocarbons draining via stormwater to the Hylebos are unknown. Organics were detected in the soils at levels above regulatory levels.

⁵² In allocating the costs of remediation, I have assigned SRS/Sussmans a 10% owner share.

Available documents do not indicate when the steam clean pit began discharging to the sanitary sewer. Although we believe that, since the steam clean pit is located in close proximity to the Hylebos, it may have drained to the Hylebos prior to the sanitary sewer connection, no specific evidence exists which would confirm this. We have taken into account this uncertainty in our attribution of an investigation cost share.

Superlon Plastic Pipe began leasing parcel 21 in 1972 and has manufactured and distributed polyethylene pipe for 27 years since that time.

The raw material, polyethylene is used, and is delivered in palletized form. Superlon uses potable water for cooling in its manufacturing process. Effluent from the cooling tank is discharged to a drainage ditch located on the south side of the pipe fabrication warehouse. Lubricating oil wastes are generated from the manufacturing process. Used oil is disposed off-site.

In 1990, high concentrations of metals (lead and arsenic) and PAHs were found in soils and water drainage ditches surrounding the storage warehouse building. Drainage from these ditches was determined, ultimately, to flow to the Blair Waterway. According to a 1991 report, the northern portion of the site drains to a ditch adjacent to Taylor Way that flows to the west to the intersection of Lincoln Avenue and Taylor Way. The drainage then flows north to a ditch that runs along Lincoln Avenue and ultimately discharges to the Hylebos Waterway (outfall No. 66). The area south of the building slopes toward the Blair Waterway.

Given the uncertainty regarding the pathway to the Hylebos, we have attributed a minimal release of metals and PAHs to Superlon.

Sussman, Leslie -- Please see discussion, above, under SKS properties/Sussmans and General Metals

Swindahl, Carl and Elaine, a second round cash-out party, founded Modutech Marine in 1971. Carl Swindahl and his family purchased parcel 52 in 1992 and have leased it to Modutech Marine since that time. We have attributed a minimal share to the Swindahls as owners. Please see the discussion, above, under Modutech Marine.

Tacoma Boatbuilding has conducted significant boat building operations on parcel 1 for 19 years and parcel 43 for 30 years. It also is associated with operations on parcel 4 for 2 years, and parcels 5, 60, and 61 for unknown time periods.

The dates of Tacoma Boatbuilding's lease on parcel 1 are not definitively established. Striplin Environmental's Summary of Existing Information indicates that Tacoma Boatbuilding leased between 1969 and 1987. Tacoma Boatbuilding's Yard #3 was located at this parcel. Tacoma Boat designs, builds, and repairs ships and motor yachts. Operations included construction and fabrication, installation of materials and equipment, and surface preparation and coating. Hydroblasting and sandblasting also occurred on two dry docks located on Piers 24 and

25. Hydroblast wastewater was discharged directly to the Bay.⁵³ Potential releases of metals are associated with these operations. Spent grit, which accumulated on the ways, is another potential source of metals to the waterway. We have assumed modest releases from activities Tacoma Boat's operations on parcel 1.

Tacoma Boatbuilding moved its main facility to parcel 43 in 1969. The site was developed in 1969 using clean fill. Potential contaminants originating from this parcel include metals, e.g., arsenic, zinc, copper, lead (from sandblasting grit and sandblasted paint chips); PAHs (from petroleum products such as fuel oil, lube oil, etc.); VOCs (from leaking solvent drums, paint overspray, gasoline UST); and TBT (from paint overspray, sandblasted paint chips).

Discharges from the site consist primarily of stormwater drainage and hull washing wastewater. The entire site is paved. Surface runoff is discharged to the Hylebos via eight storm drain systems and the two marine launch ways. Stormwater runoff is estimated to be 17.1 million gallons per year. Hull washing is conducted on the launch ways. It involves lower pressure washing and is not intended to remove paint from the hulls. Approximately 140,000 gallons per year of hull wash wastewater is discharged to the Hylebos.

Metals: Reportedly, no Asarco slag was used to fill the site. Metal slag (a copper smelting by-product) is used for sandblasting. Historically, sandblasting was performed near the uncovered bulkhead area. Sandblast grit is stored in large hoppers throughout the plant. Residual grit was found throughout the site, especially near the bulkhead. Although blasting and painting sheds are located well on-shore, there are storm drain catch basins that could collect and discharge any spent grit that escapes. Samples collected in January 1987 contained relatively higher concentrations of arsenic in older sandblast grit as compared to newer sandblast grit. The new deposits contained higher levels of lead and zinc. Soils in the drainage ditch on the northeast portion of the site contained high levels of arsenic, copper, zinc, and lead. Storm drain sediments, which may have been comprised primarily of sandblast grit, contained high levels of arsenic, copper, and zinc.

Stormwater samples collected in 1991 were found to contain elevated levels of metals. Materials which may contaminate the stormwater discharge include spent blasting grit, anti-foulant and anti-corrosive paint overspray, paint chips, scrap metal, welding rods, and miscellaneous solid waste. Zinc and copper are common components of marine paints and blasting grit.

PAHs: Cutting and lubrication oils are used in the machine shop. A gasoline UST was located near the entrance gate. It was repaired in approximately 1977 when water was detected in the gasoline. Several oil (diesel, lube oil) spills associated with the facility have reached the Hylebos. In 1994, two fuel ASTs with no secondary containment were

⁵³ In May 1989, the Department of Ecology reported that pressure washing and sandblasting operations were taking place under the barge and that grit was placed all over the ground and along the bulkhead. Ecology reported that there was no attempt being made to control the spent grit that was accumulating on the ways in depths of one-half to six inches. It is not clear whether this reference was to Tacoma Boatbuilding.

noted by City inspectors. Stormwater samples collected in 1991 were found to contain small concentrations of oil and grease.

VOCs: Painting operations include a primer, finish coat and anti-fouling paint. Solvent is used in formulation and cleanup. Small scale painting is performed in the paint shop. In 1989, no TBT paint was observed. MEK is the primary solvent used in painting operations. Historically, paint wastes were accumulated in drums and stored around the parcel. As of 1987, paint wastes were being distilled. VOCs such as BTEX may have been released from the gasoline UST to the groundwater. Approximately 700 drums collected in 1985 as part of a waste control effort were being stored near the entrance gate in 1987. Available information indicates that paint sludge, solvents and MEK were disposed in the waterway. Solvent drums were found leaking on the ground. There has been a history of leakage and spills associated with the metal cleaning dip tanks. VOCs were detected in soils in the drainage ditch in the northeast portion of the site. Soils near the UST and the hazardous waste storage area contained elevated levels of VOCs (1,1,1-TCA, toluene, xylene). Stormwater samples collected in 1991 were found to contain small concentrations of SVOCs. Materials that may contaminate the stormwater discharge include anti-foulant and anti-corrosive paint overspray, cleaners, solvents, anti-corrosive compounds, and miscellaneous solid waste.

TBT: About 10% of the painting is done with TBT paint.

We have attributed appreciable releases of the above chemicals from Tacoma Boatbuilding's operation on parcel 43. We have no basis for an allocation of shares to Tacoma Boat for parcels 4, 5, 60, and 61.

Tacoma Powdered Metals operated a powdered metals facility on parcels 11 and 12 for about 7 years in the late 1940's and early 1950's. We do not have much information about this operation. We have inferred that it is a possible source of metals contamination associated with this parcel. We have attributed it a modest release of metals in elevated concentrations and PAHs (from lube oils).

Taylor Way Properties, a second round cash-out party, has owned parcels 11 and 12 for the past 13 years. Taylor Way has not conducted any operations on the parcel. However the parcels are contaminated and are believed to be a continuing source of contamination of the Hylebos. Taylor Way has conducted investigations, and has taken voluntary steps to remediate certain upland portions and shoreline areas of the parcel in order to prevent migration of contaminants to the Hylebos. Taylor Way has already spent \$250,000 to control the areas of potential sources of contamination to the Hylebos.

Contaminants of concern associated with historical operations on this parcel include PCBs, metals, and PAHs. Soils on the property and shoreline along the Hylebos Waterway have been contaminated by metals. Material that was found during an investigation in the western bank of the ditch where it joins the waterway and a composite of material from a pile of drums revealed high levels of metals. The samples from the drummed material also contained high levels of PCBs. These contaminants have also been found in tanks, drums, and vats used in

operations on the parcel. The primary migration pathway for these contaminants to the Hylebos would be via erosion of the contaminated soils. PAHs have been detected in sumps and ditches. Potential releases of PAHs may migrate to the Hylebos via the wetland/swale drainage culvert that discharges to the Hylebos.

We have attributed to Taylor Way properties, as the current owner of a parcel with migration of contaminants to the Hylebos, a modest release of elevated concentrations of metals, PAHs and PCBs.

While I believe that it is reasonable for a current owner of a parcel on which remediation is required to bear a significant equitable share for the parcel, that equitable responsibility should not be as great in the case of off-site contamination caused by the operations on the parcel. Taylor Way has not conducted any operations on the parcel. Releases on the parcels stemming from operations prior to Taylor Way's ownership are believed to be a continuing source of contamination of the Hylebos. Contaminants of concern associated with historical operations on this parcel include PCBs, metals, and PAHs. However, as noted above, Taylor Way has conducted investigations, and has taken voluntary steps to remediate certain upland portions and shoreline areas of the parcel in order to prevent migration of contaminants to the Hylebos. Accordingly, the RM and SQO scores for Taylor Way's investigation cost share reflect 25% of the investigation cost share for the parcels.⁵⁴

Todd Shipyard originally developed parcel 1 and a portion of parcel 2 in 1917 for the production of ships during World War I. The United States was materially involved in the shipyard during World War I, and I have assumed that the United States would be allocated a share for this involvement.⁵⁵

At the termination of World War I, Todd Shipyards' government contracts were less than half completed. Of the 34 ships assigned to it (12 of which were subsequently cancelled), plus the 5 for Britain and the *Masuda*, it had launched 7 and delivered 6 before the Armistice. All of the remaining ships due under the contracts were apparently completed. The yard also produced passenger ships before it was phased out in 1925.

Operations were dormant between 1925 and 1939. After demolishing certain shipyard facilities, Todd sold approximately 10.5 acres to Hooker Chemical, and that property is considered to be part of parcel 2. In 1939, the United States Maritime Commission entered into contracts with a newly-created Todd Shipyards subsidiary, the Seattle-Tacoma Shipbuilding Corporation (STSC). In September 1942, the Navy, through the Bureau of Ships, informed STSC that the Navy would be taking over the contract between STSC and the Maritime Commission. By October 1942, it appears that the Navy was overseeing the contract and the

⁵⁴ It appears that Taylor Way Properties also owns a significant percentage of the "property" (sediments) in SMA 221. However, an ownership share of 25% adequately takes this into account, in my view.

⁵⁵ In April 1917, the Emergency Fleet Corporation (EFC) was established to serve as the ship construction and acquisition arm of the U.S. Shipping Board. Its duties were expanded in June 1917 to include the acquisition and, if necessary, the requisition and construction of shipyards. The EFC apparently insisted that the Tacoma yard be "expanded and devoted entirely...to the construction of standard freighters." TOD1040020-21.

operations of the shipyard. In 1943, the United States acquired parcels 5 and 6 from Evelyn Clapp, and they became part of the shipyard operations. The shipyard was very active during the war, and construction of ships was reported to have taken place at an extremely rapid pace.

The construction of the ships involved a large amount of ongoing treatment and maintenance to protect the ships from corroding. The maintenance generally involved painting completed portions of the ship, scraping or sandblasting and then repainting, and lubricating parts with oil and grease. Painting was a substantial activity at the shipyard and was conducted at several locations at the shipyard, including areas along the Hylebos Waterway. Considerable amounts of solvents were widely used. In addition, bordering the Hylebos were two transformer houses and two incinerators.

Specific information regarding the use and disposal of hazardous substances is limited. A report of the Navy's activities indicates that waste management activities at the shipyard were almost non-existent. Due to the rapid pace of construction, a graveyard shift was needed just to keep the shipyard clean. Reportedly, disposal systems were very primitive, and much of the waste was disposed in the Waterway. This has been documented in historical photographs. During World War II, the Waterway shoreline area between Parcels 1 and 2 was used by the shipyard for incineration and waste disposal. In 1948, Todd conveyed the shipyard property it owned to the United States.

Potential releases to the Hylebos from Todd Shipyards during 1917-1948 include disposal of PCB-contaminated material, metals from sandblasting and painting operations, disposal of hazardous materials into the waterway, oils and grease from spills and bilge water dumping from Navy ships, and use of two transformer houses located along the waterway. In view of the extensive degree of involvement of both Todd and the Navy in shipyard operations, we have divided the investigation cost share for Todd Shipyards activities equally between the Navy and Todd.

U.S. Air Force purchased parcel 4 in 1951 from General Petroleum Products. The Air Force used the facility until 1965 when 0.7 acres was transferred to the Department of the Navy and the remaining 3.95 acres were reported to the General Services Administration for disposal. The 3.95 acres were conveyed to the Port of Tacoma on August 30, 1966. The Air Force used the facility as a bulk petroleum storage depot from which petroleum products were distributed to McChord Air Force Base.

Various sources refer to an area in which the U.S. Air Force is alleged to have buried sludge. This area was presumably located in the southwestern portion of the parcel, immediately adjacent to parcel 3. Historical photographs depict a bermed impoundment area in that location, with stained soils. On-site soils had the characteristics of gasoline, heavy oil, and diesel fuel containing TPHs and organics (benzene, toluene, ethylbenzene, and xylenes), and the groundwater contained free product that had the characteristics of gasoline and diesel fuel. Releases of these contaminants area associated with the petroleum storage facilities used by the Air Force, F.O.F., Lilyblad Petroleum, and PRI Northwest.

In light of documented sludge disposal, and significant groundwater contamination, we have attributed a modest release of PAHs, metals and organics associated with the Air Force's activities.

U.S. Dept. of Defense (Assume U.S. Defense Plant Corporation or Reconstruction Finance Agency) is attributed modest releases of contaminants relating to its involvement in World War II plants on parcels 2, 24, and 30. See discussions, above, under Occidental, Kaiser, and Olin, and below, under USG.

U.S. Government Bonneville Power ("BPA") has owned parcel 31 and operated a substation on it since 1944. High-voltage electrical equipment, including transformers and capacitors, has been used on this site. Other facilities included a control house, an oil house, oil storage tanks, and a condenser building.

Contaminants associated with this parcel include: PCBs (from electrical equipment); VOCs (from Occidental sludge); PAHs (from oil filled equipment); and metals, particularly zinc and arsenic (from USG shot material).

Pathways from the site to the Hylebos consist of stormwater flow conveyed via ditches and groundwater. It does not appear that any process water or cooling water was discharged from the site. Historically, drainage appears to have flowed east and north off the property to the discharge canal located on the western side of the aluminum reduction plant. The canal discharged to the Hylebos Creek, which entered the Waterway near the present-day middle turning basin. When the Waterway was extended, the discharge canal connected to the "Kaiser" ditch. Sometime between 1968 and 1984, during the expansions of both the substation and the aluminum plant, this pathway was cut off and created a pond. Since then, stormwater has either ponded on the site or been discharged to the Blair Waterway.

Stormwater also flows eastward in two ditches, which join together before leaving the property. One ditch flows along the southern portion of the transmission line right-of-way to East West Road where it is joined by the second ditch, which is located along the western and southern boundaries of the Taylor Way property (Parcel 35). The combined ditch flows into the Fife Ditch, which discharges to Hylebos Creek upstream of the Waterway. Occidental's sludge was located to the south of the ditch that discharges to the Fife Ditch.

The direction of groundwater flow from the site is not certain. Groundwater may flow southeast from the site to the Fife Ditch or it may migrate north, east, and south of the substation. A consultant investigating Parcel 31 concluded that groundwater is an insignificant source of off-site contamination.

PCBs: Some of the electrical equipment contains PCBs. Despite the lack of documentation of any spills or leaks of PCB oil, PCB contamination has been found in sediments and soils on the site. PCBs were detected at a level of 0.42 mg/kg in a stormwater pond on site. They were also detected in the surface sediment of the ditches on the eastern side of the parcel. Samples collected from the estimated location of an historic ditch on the western portion of the site were found to contain elevated levels of

PCBs. Available information suggests that PCBs from this parcel may have reached the Hylebos.

PAHs: Releases of oil from oil storage tanks or the oil storage house may have resulted in PAH contamination of surface soils and eventual contamination of surface water runoff. Samples collected from the estimated location of an historic ditch on the western portion of the site were found to contain elevated levels of PAHs.

VOCs: Relatively inert lime sludge from Occidental was disposed on the property circa 1972. The sludge contained chlorinated organics (primarily trichloroethylene and tetrachloroethylene), heavy metals and asbestos. The sludge was ultimately consolidated and capped on site pursuant to a Consent Decree involving the Department of Ecology.

Metals: Sample analysis of a pile of grit-like debris or "shot," which was found on the eastern end of the property, near the ditch revealed elevated levels of arsenic, copper, mercury, zinc, and lead. This material is believed to have originated from U.S. Gypsum. Several truck loads of materials were subsequently removed from the site. Elevated levels of zinc were found in sediment samples collected from the outfall to the stormwater pond. Samples collected from the estimated location of an historic ditch on the western portion of the site were found to contain elevated levels of zinc, and arsenic.

We have attributed a minimal release of the above contaminants at elevated concentrations.

U.S. Navy and Marine Corp. Reserve (U.S. Naval Reserve Training Center) has operated a Naval and Marine Corp Reserve Center on parcels 5 and 6 (including the pier that fronts parcels 5 and 6) since the late 1940's. The Reserve Center serves as host command for local Navy, Marine Corps, Army, and Coast Guard training units. The Reserve Center operates administrative facilities, shop facilities, and pier facilities for training purposes. The Reserve Center is also homeport for two to three vessels.

Activities at the training facility included painting and minor repair. Typical wastes generated by these activities include oils, fuels, solvents, paints, and batteries. Shop facilities were used for only minor maintenance operations such as oil changes. In 1988 it was reported that these activities generated from 1,000 to 2,000 gallons of hazardous waste per year, consisting of oil, fuel, solvents, and batteries. Hazardous waste manifests identified the disposal of tetrachloroethylene, acids, mineral spirits, waste paint, and sodium phosphate. Oil was stored in seven underground storage tanks. Four of the tanks were located within 100 yards of the Hylebos Waterway. Six of the tanks were removed between September and November of 1993. Subsequent to removal, testing revealed that water and soil from the excavation pit were contaminated with total petroleum hydrocarbons. All contaminated soils were removed and disposed off-site.

In December 1982, the facility was expanded. The facility was responsible for operation of the repair barge. Facilities aboard the barge include a machine shop, a valve and pump shop, a welding shop, an electrical shop, a sheet metal and pipe shop, carpentry shop, and a sail loft.

The Reserve Center collects and treats oily wastewater generated by the homeported vessels. The vessels pump oily bilge wastewater through lines on the pier, which are collected on shore in a 1,500-2,000 gallon above ground tank. The oil is then pumped to an oil/water separator. The treated effluent is discharged to a sump that ultimately discharges to the City of Tacoma sanitary sewer system. The treatment system was installed by June of 1976. Previously the separator discharged to the Hylebos. Historically, there were repeated instances of oil spills and oily bilge wastewater discharges to the Hylebos Waterway from the facility and the homeported vessels. A Department of Ecology inspector attributed recurring oils spills that he observed on the waterway some time prior to 1972, to bilge water dumping from the training vessels.

The automotive washrack drain was connected to the Reserve Center's storm sewer system that drained directly into the Hylebos Waterway. As of 1992, the Reserve Center did not have a wastewater permit for this discharge.

As of May 1982, there was a 100 KVA transformer containing 206 gallons of PCBs adjacent to the Hylebos Waterway. The transformer was scheduled to replace the PCB-filled transformer with a non-PCB transformer in 1983.

The Navy Commissioning Pier was located along the waterway adjacent to parcel 5, an area considered part of parcel 6. Ships were docked at this pier for work. A steel storage yard and an incinerator were located on the parcel near the waterway. It is not clear exactly what activities were conducted at this pier, and specific information regarding the use and disposal of hazardous substances is limited.

We have attributed modest releases of PAHs and minimal amounts of organics and metals from parcel 6.

U.S. Navy oversaw (and, during World War 1 and World War 2, may have controlled) shipyard operations on parcel 1, part of parcel 2 and parcels 5 and 6. The U.S. Navy oversaw the shipbuilding contract with Todd during World War II. See discussion, above, under Todd Shipyards. In March 1948, Todd Shipyards conveyed the property to the United States. The U.S. Navy operated the parcel as the U.S. Naval Station, Tacoma until 1960, when it sold the parcel to the Port of Tacoma. Ships of the Pacific Fleet were berthed at this Naval Station. A separate entity known as the U.S. Navy Tacoma Group, Pacific Reserve Fleet, was established for the ongoing maintenance of the ships. The Navy scrapped more than thirty escort carriers during the 1950s. The Navy also acknowledges that ships may have been scrapped on the waterway from 1946 to 1948 as well. Maintenance activities included scraping, sandblasting, and repainting of the ships' upper hulls to prevent corrosion. The Navy also used the site to ship military cargo, 61,000 tons between July 1953 and June 1954. Ship repair operations continued until the United States sold the property to the Port of Tacoma in 1960.

Most vessels built before the 1970s contained hazardous materials including PCBs, asbestos, as well as large quantities of lead-based paint. In the late-1980s the Navy discovered that a wool felt insulating material, widely used on Naval vessels, contained PCBs in high

concentrations (generally 15-30% by weight). In addition, many common materials, including plastics, paints, rubber parts, and adhesive tape, contained PCBs in concentrations above 50 ppm.

From 1960-1975, Zidell Dismantling scrapped ships provided by the U.S. Navy. There is some indication that waste oil removed from an aircraft carrier by Zidell Dismantling was stored in concrete tanks on the parcel 11/12 in the late 1970's. Reportedly, the waste oil contained a flame retardant, which we have inferred may have contained PCBs. Navy ships also were scrapped by General Metals during the 1970's and, possibly, the 1980's.

In addition to hazardous materials used and disposed of during the Navy's operation and control of parcel 1, spills and bilge water dumping from Navy ships have also been a concern. Between 1946 and 1960, the Navy berthed ships at parcels 3, 4, 5, 6, and 67. Operations during the early portion of the Navy's ownership on parcel 5 generally involved shipbuilding and repair. During this time period, the Naval Industrial Reserve Shipyard conducted operations on the parcel. The Navy Commissioning Warehouse was located on this parcel. Railroad tracks from the warehouse ran from the center to the Maxwell Petroleum Company located on the adjacent parcel 4.

We have attributed major releases of PCBs, PAHs and other compounds to the Navy activities on parcel 1. We also have attributed modest chemical releases for the dumping on parcel 2 and ship berthing on other parcels. We have divided the investigation costs share for equally between the Navy and Todd Shipyards for shipbuilding activities and 35% Navy/65% Zidell for ship scrapping activities. We also have attributed minimal shares to the Navy as an arranger for waste oil on parcel 11/12. Finally, the Navy is attributed a 32% share at parcel 45 for the time period during which ships dismantled at General Metals.

USG Interiors, a second round cash-out party, as a successor to U.S. Gypsum, has owned parcel 24 and operated a rock wool manufacturing plant on it from 1959-1996. The plant was built in the 1940s as a calcium carbide plant by the Defense Plant Corporation and initially leased by Pacific Carbide & Alloys Co. The Defense Plant's calcium carbide plant reportedly produced approximately 10,000 tons of carbide a month using lime, coke, and carbon paste.

USG Interiors also is associated with the disposal of waste by products on parcels 31, 76 and, possibly 77.

Elevated metals have been detected in site soils, stormwater, and groundwater. Sources of the contamination are believed to be the spent shot and baghouse dust, which was, at the time Ecology issued an Agreed Order in 1993, deposited on the site between the production plant and the Hylebos Waterway. Elevated metals were detected in seep samples in 1980 and 1992 indicating that there is an ongoing source of metals to the Hylebos Waterway. Samples collected from the soil berm, located between USG and Murray Pacific, in 1993 revealed that samples in the northeast half of the berm contained elevated levels of arsenic and lead.

From 1959 to 1973 Asarco slag was used as a raw material. In 1973 the plant switched to steel slag and basalt rock. Spent shot was generated from the production of mineral wool, and has been generated since 1959. Generally, the shot was not stored on-site while Asarco slag was

being used, but at some unknown time period, about a two-week production of shot, while Asarco slag was used, was stored in the intertidal area. Contaminants associated with spent shot (during use of Asarco slag) include arsenic, copper, lead, and zinc. Baghouse dust was also generated from the process. The baghouse dust consists of generally small particles. The material collected in the baghouse dust contained about 23% arsenic and 8.5% lead, by weight. Analyses of the material contained arsenic, lead, copper, and zinc. According to USG, the baghouse dust was not stored on-site.

Petroleum contaminants have been detected in subsurface soils and groundwater at the site. The hydrocarbons may have originated from a former above ground storage tank and migrated to the shallow groundwater. The tank was reportedly used to fuel the plant boilers until the late-1960s or early-1970s, and contained heavy oil, which has been referred to as Bunker C or No. 6 fuel oil. In late-1992 the 17,000-gallon above ground storage tank was removed from the area between the plant and the Hylebos Waterway. The tank was out of service for approximately three years prior to its removal. During tank excavation, total petroleum hydrocarbons (TPHs) quantified as diesel fuel (likely representing the lighter fractions of bunker C fuel oil) were detected at concentrations above regulatory cleanup levels in subsurface soils and groundwater. TPH contamination was also observed in the groundwater.

There may have also been small amounts of ash generated from the burned coke used in the process. The coke contains small amounts of sulfur. The coke was stored onsite in a bin on a paved area, located approximately 200 feet from the Hylebos Waterway and piled behind the paved area. PAH releases from coke storage or burning may have occurred.

A consultant for USG has submitted an opinion that neither Bunker C fuel nor coke is the source of PAH contamination found in intertidal samples adjacent to USG's former plant site. However, we found the research supporting this opinion to be somewhat insubstantial.⁵⁶

USG has estimated the loadings of arsenic that would have been present in groundwater seeps and stormwater runoff from the berm located over the stormwater discharge line and source materials on the bank. This estimate does not appear to account for potential releases of arsenic from cupola bottoms, baghouse dust, and shot that were discharged into the Hylebos, and may, therefore, underestimate arsenic loadings. However, loadings from USG are much less significant than those from the Elf Atochem plant. We view them as roughly comparable, on average, to runoff from log yards with Asarco slag.

We have attributed to USG a modest release of PAHs and metals at elevated concentrations for parcel 24. We also have attributed it an owner share for logyard operations on property it leased beginning in the 1970's. We have attributed minimal releases for disposal activities at parcels 76 and 77.

⁵⁶ I have assumed that runoff from coke piles and ash from coke are potential sources of PAHs. Coke is a product of carbonized coal. Coal tar is produced as a by-product and remains with the coke. Metallurgical coke, a cheaper grade of coke most likely used in this plant, is generally subjected to lower temperatures, and likely had larger residuals of coal tar and other materials.

Vance Lift Truck, a first round cash-out party, has operated on parcel 7 since 1967, repairing and reconditioning lift trucks (approximately 12-16 per month). Waste lubricants generated in this operation apparently have historically been collected and disposed off site. As far as we can determine, the sole source of potential release of contaminants is from pressure washing of the fork lift trucks. Contaminants from this operation could include oil and grease. We have no information on the volume of washings generated in this operation. Around 1970, Vance installed an oil/water separator for use in conjunction with the pressure washing of forklift trucks. Oil was skimmed off of this separator for off-site disposal, while remaining effluent from the oil/water separator drained directly into the ground. In 1988 a new oil/water separator was installed. Effluent from the new separator discharges to the City sanitary sewer.

We note that there is no indication that the discharge flowed to the Hylebos from the oil/water separator, and, even if it did, the volume would have been minimal. We have attributed to Vance minimal releases of PAHs.

Wasser & Winters leased parcel 36 for use as a log sort yard for 12 years from 1972-1984.

Potential pathways of contamination include surface runoff to the Hylebos Creek, to the Hylebos Waterway, and to a ditch on the eastern side of the site that appears to ultimately discharge to Hylebos Creek. An oil/water separator was installed in the ditch in 1983, suggesting some lack of controls on oil releases prior to that year. Groundwater is another potential pathway. Seeps along shallow subsurface layers into the Hylebos Waterway were observed in 1986.

Approximately 50,000 cubic yards of log debris was removed from the site between 1977 and 1988.

Heavy equipment used by log yard operators may be a source of PAH-contamination. Documents from the mid 1970s to the early 1980's indicate releases of oil to the ground and Hylebos Creek and disposal of waste, including oil filters, on the creek banks. A 1,000-gallon underground storage tank was removed from the southeastern side of the parcel circa 1990 or 1991. The Port conducted the remediation associated with the storage tanks. Samples collected from the excavation contained TPH above state cleanup levels.

We have attributed to Wasser and Winters a modest release of PAHs and phenols.

Western Superior Structural Mfg. has operated on parcel 73 for 26 years.

Western operates a structural and miscellaneous steel fabrication facility at this site. Operations include cutting, welding, metal cleaning, and painting. Primers used include red oxide and zinc chromate. Wash thinners are also used. In 1986, solvent-soaked rags were being used to clean parts in the open yard. Excess solvent was squeezed back into the bucket and any spills to the ground would be washed away.

In late 1986, paint products and contaminated sediments were being discharged to the 67th Avenue storm drain system, which discharges to the Hylebos Creek. Paint overspray was

observed entering the storm sewer via a manhole and also seeping into the ground. At this time, a large ponded area in front of the shop was observed to have a reddish-brown color from the red oxide primer and metal shavings.

As of 1987, painting was conducted in a paint room or on drop cloths and a berm had been installed to contain surface runoff. Western constructed a sediment basin with baffles in the paint area to alleviate the runoff problem.

Prior to 1985, stormwater runoff from Highway 99 flowed along the gravel shoulder of the highway, away from Hylebos Creek. In 1985, after 67th Avenue was reconstructed, the Western yard began to experience flooding after heavy rains. A December 1986 WDOE inspection report indicates that stormwater flows north approximately 500 feet to the Hylebos Creek, which ultimately discharges to the Hylebos Waterway. Analysis of sediments collected from a drainage ditch outfall to the Creek indicated low levels of copper, zinc, chromium, and lead.

We have attributed modest releases of low levels of metals (from machining, as well as primers and paints) and VOCs (from paints).

Weyerhaeuser, a second round cash-out party, has owned and operated a log export facility on parcel 29 since 1970. It also has conducted log scaling operations on parcel 35 since 1972.

Weyerhaeuser used the property as a log sort yard. It paved half the property and constructed a dock shortly after purchasing the property. Several years later, Weyerhaeuser paved the remainder of the parcel. Asarco slag was never used as ballast on this parcel. The facility has received logs by raft, rail, and truck. Equipment used includes log stackers and debarkers. Weyerhaeuser states that hydraulic equipment is inspected for leaks every day and oil pans are placed beneath parked equipment to catch any leaks.

In the past, trucks were washed on a concrete pad and water drained to the old railroad area. Any debris would have been scooped up and put with the bark. Since 1986, trucks have been washed with a high-pressure fire hose under a roofed area. Wastewater flows into a catch basin, through an oil/ water separator, and into the sanitary sewer. The oil / water separator was connected to the sanitary sewer some time after November 1990.

Five underground storage tanks were located on the parcel from 1970 to 1991. The tanks contained diesel (2 tanks), waste oil (2 tanks), and unleaded gasoline (1 tank). After free product (diesel) was found in a monitoring well, the tanks were permanently closed in place by filling with sand and cement.

None of the four transformers placed on site after 1970 contain more than 18 ppm PCBs.

Sandblasting occurred in limited instances in June or July 1991. Sandblast grit piles noted in November 1990 had been cleaned up by June 1992.

Sediment churning from minimal ship clearances and possible abrasion of hull paints containing TBT has been mentioned as a possible source of TBT in the waterway, particularly in the turning basin near this parcel. However, none of the ships servicing the log expert facility are owned by Weyerhaeuser.

Elevated zinc and copper levels were detected in the northwest collection system discharge pipe in 1989. Possible zinc sources included hydraulic oil and, as a result, Weyerhaeuser switched to a zinc-free oil.

Stormwater runoff is the primary potential pathway for chemicals of concern to be transported to the Hylebos. Before the yard was paved in 1975, some dry wells were used to collect surface water. When the yard was paved, catch basins were installed. Historically, there were three pathways for stormwater to reach the Hylebos: a direct discharge from a vault on the southeast corner of the parcel and two storm drains to the "Kaiser" ditch.

In 1982, oil had been directed from the shop area to the ditch along Taylor Way. The Taylor Way ditch connected to the City storm sewer, which enters the Hylebos near Kaiser Aluminum. In 1990, oil was noted in the "Kaiser" ditch upstream of Weyerhaeuser's middle outfall. Potential sources included the wash pad oil /water separator and equipment lubrication in the yard.

For some period of time, cooling water from the debarker was discharged to the "Kaiser" ditch. Currently, the cooling water is recirculated.

Contaminants potentially associated with operations on parcel 29 include: PAHs (truck and equipment wash water and leaks, USTs, spills), VOCs (USTs), metals (sandblast grit, zinc and copper from hydraulic oil) and phenols from woodwaste. Because of the size of the facility, and the fact that paving it may have enhanced stormwater runoff, we have attributed to it a modest release of low-to-elevated levels of PAHs, petroleum-related organics, metals and phenols.

On parcel 35, groundwater sampling and analysis circa 1988 revealed zinc, antimony, TCE and other VOCs in the groundwater on the southern portion of the site. Problem chemicals detected in soils, sediments, and groundwater were below action levels. Potential pathways to the Hylebos Waterway consist of surface runoff via the Fife Ditch and groundwater migration. We have attributed only minimal releases of metals, and organics from this parcel.

I believe that the investigation cost share in the PAR adequately strikes the balance between the magnitude of wood waste releases and the fact that Weyerhaeuser, as a member of the Wood Debris Group, has funded wood waste investigations in the Head of the Waterway.

Woodworth & Co. has owned and operated a gravel mine on parcel 47 since 1938. Woodworth also washes and crushes gravel and, since 1964, has operated an asphalt hot mix batch plant at this location. Materials are stored at the southern end of the site.

Gravel is mined on the western side of the site. After mining, it is hauled to the washer, washed, graded, and sent to the crusher. Washing is accomplished with a combination of recycled and clean make-up water. Spent wash water flows to the first settling pond where some fines settle out. Then, it flows to a second pond for further settling. Water from the second pond is recycled into the washing process. The second pond also contains two overflow pipes that are directed to an unlined overflow pond adjacent to Norpoint Way. Crushing is a drying operation and generates heat that is dissipated by once-through cooling water from Woodworth's well. Cooling water is also directed to the unlined overflow pond.

The settling pond system was not used prior to 1962. Before then, wastewater flowed directly to the storm drain.

The hot mix plant is located adjacent to Norpoint Way. Asphalt cement is stored in three electrically-heated storage tanks. No. 2 diesel oil, stored in 12,000-gallon and 10,000-gallon tanks, is used to fire the plant. Baghouse dust is recycled into the pug mill. Other materials used in plant operations include antifreeze and gear oil lubricant.

Numerous incidents of high turbidity discharges have been documented since 1962.

In 1991, an inspection revealed that unlabeled wastes were being stored on the construction storage site. Inspectors also noted leakage around the asphalt mix plant.

Release pathways associated with parcel 47 include intermittent process water overflows of wash water and cooling water from the overflow pond. The overflow pond discharges to the storm drain system, which is connected to the City's Morningside Drain. The Drain empties into the Hylebos at Outfall No. 28 near the Hylebos Marina.

Potential contaminants associated with parcel 47 include PAHs from possible spills or leaks from diesel fuel tanks and other operations at the asphalt mix plant. Suspended solids are associated with the gravel mining and washing operations but are not contaminants of concern with respect to the Hylebos. We have attributed a modest release of PAHs from this facility.

Woodworth has owned and may have operated gravel operations on parcels 54, 56 and 57. However, we have not identified activities or releases related to Woodworth that we believe merits an investigation cost share.

Wright Marine Towing has operated on parcels 58 and 59 since 1986. Wright Marine Towing operates a tug moorage facility located at the east end of the 11th Street Bridge. Operations are conducted on a pier. There is no evidence in the record of spills or releases associated with the moorage facility. We have assumed minimal releases of petroleum compounds from the barrels of oil which are stored on the dock over the Tideflats. The Department of Ecology has noted that there was no containment around the tanks. The pier drains to the Mouth of the Hylebos Waterway.

Zidell Dismantling leased a portion of parcel 1 from the Port of Tacoma from January 1960 until May 1984. Zidell's operations included ship dismantling, from 1960 to the mid-1970s, and

barge building, from the mid-1970s through 1983. Many of the dismantled ships were Navy ships. In 1960, Zidell had a permit to discharge 5,000 gallons per day of ballasting wastewater via surface runoff to the west side of the mouth of the Hylebos Waterway. By 1975, the volume of the discharge had increased to 15,000 gallons per day, via settling basins and separator to the Hylebos. Parameters regulated under the permit were oil and grease.

Zidell dumped solid waste that was removed from the ships onto the tidelands. The waste included anything that was not saleable or salvageable and consisted of floor sweepings from welding operations, woodwaste, and insulation. The material that was dumped along the shoreline eventually wound up as fill in the waterway.

The practice of removing oil from the ships prior to dismantling them was not instituted until at least July of 1970. Several oil spills, which occurred during dismantling operations, have been documented between 1970 and 1975. An Ecology inspector testified that, almost every time that he inspected the property, the banks were oily. The inspector concluded that it was just a messy operation.

During its approximately 24 years of operation, Zidell Dismantling released hazardous materials that potentially contained PAHs, metals, organics, and PCBs to the Hylebos. Zidell was permitted to release ballasting wastewater to the Hylebos. Zidell also released oils and grease to the waterway. For approximately ten years Zidell released bilge waters to the waterway, and oil spills were recurrent. We have attributed a major release of these contaminants to ship scrapping operations, attributing a portion of the investigation cost share for ship scrapping to the Navy, Zidell and the Port of Tacoma. We have attributed a modest release for Zidell's barge building operations and a minimal release relating to storage of waste oil on parcels 11/12.